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September 24, 2010
11478-26

BY E-MAIL (NBH Comments@epamail.epa.gov) & U.S. FIRST CLASS MAIL

Mr. David Dickerson
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5 Post Office Square
Suite 100 (OSRR07-4)
Boston, Massachusetts 02109-3912

**Re: New Bedford Harbor Superfund Site, June 2010 DRAFT – Fourth
Explanation of Significant Differences for Use of a Lower Harbor CAD Cell**

Dear Mr. Dickerson:

This letter provides the comments of AVX Corporation (“AVX”)¹ on the *June 2010 DRAFT – Fourth Explanation of Significant Differences for Use of a Lower Harbor CAD Cell* (“ESD #4”) at the New Bedford Harbor Superfund Site in New Bedford, Massachusetts (the “Site”). These comments are timely based on extensions of the public comment period to September 24, 2010. These comments have been prepared with the expert technical assistance of URS Corporation (“URS”) and Dr. Robert Engler. Resumes for Dr. Engler and URS scientists, engineers and other personnel who worked on this project are attached.

AVX’s position with regard to EPA’s latest proposed modification of the remedy for the Upper and Lower New Bedford Harbor (first operable unit (“OU1”)) echoes its past comments, that EPA has been and remains off-course. AVX has no disagreement with EPA’s belated adoption of confined aquatic disposal (“CAD”)² technology to streamline disposal of dredge spoils in any portion of New Bedford Harbor; indeed AVX would encourage EPA to utilize CAD technology for *all* future disposal. But EPA must stop its incremental approach to

¹ AVX is the sole potentially responsible party from whom the United States and the Commonwealth of Massachusetts seek to recover the vast majority of past and future costs incurred after the date of litigation settlements in the early 1990s. AVX disputes its responsibility for any such costs.

² Although EPA has called this a *confined* aquatic disposal cell in ESD #4, in earlier documents U.S. Army Corps of Engineers (“USACE”) terminology for this disposal method referred to a *contained* aquatic disposal cell.



the remedy; admit that the “existing official remedy,” to use EPA’s own words,³ is fatally flawed; acknowledge the scope of what has largely been a behind-the-scenes internal remedy review and alternatives analysis in which it has been engaged at least since December 2004; and immediately embark on a full-blown re-evaluation – in a manner consistent with the Comprehensive Environmental Response, Compensation and Liability Act (“CERCLA”) and the National Contingency Plan (“NCP”) – of the most cost-effective and environmentally-protective remedy for contaminated sediments at OU1. In the face of remediation costs that have spiraled out of control, and an uncertain timeline to complete the remedy, potentially as long as 58 years from the September 1998 Record of Decision for OU1 (“ROD 2”), EPA’s continual adjustments to and reworking of the OU1 remedy, and its public statements that further changes are yet to come, is illegal, arbitrary and capricious and inconsistent with the NCP.

AVX urges EPA to immediately put on hold any further evaluation of the Lower Harbor CAD Cell (“LHCC”) and commence a focused feasibility study in a public process designed to globally and comprehensively address all steps necessary to complete a cost-effective and environmentally protective OU1 remedy.

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³ As used in several documents provided by EPA in response to AVX’s July 28, 2010 FOIA request and further discussed in Section II.A.3. below. See, e.g., EPAFOIA000229 and 234 (included in Attachment 1). The term seems to be used ironically because the context in which it is used makes clear that EPA does not anticipate sticking with the “existing official remedy,” but rather, is spending considerable time and money evaluating OU1 remedy alternatives that will take far less time and money.



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I. BACKGROUND.

Since 1984, the approach to remediating New Bedford Harbor sediments has been a moving target. While a ROD is typically the decision document that follows from comprehensive characterization of contamination and careful evaluation of remedial alternatives, the RODs for New Bedford Harbor sediments have been only temporary concepts that EPA revises, overhauls or discards in short order.

In the case of the first ROD, which addressed the Hot Spot sediments in the Upper Estuary⁴ (second operable unit (“OU2”)), EPA determined that the Hot Spot sediments would be incinerated on site, despite substantial criticism, including from AVX. EPA reversed its decision to incinerate when confronted with objections from the community, and in 1992 decided instead to store them on site until it could identify an appropriate methodology for final treatment of the sediments. After several years and tens of millions of dollars, however, EPA decided to abandon the concept of treatment and on-site storage of the sediments, and issued a ROD Amendment in 1999 that specified the sediments would be transported off site for disposal in a licensed landfill.

ROD 2 itself was the product of an extended process. The OU1 feasibility study was issued in August 1990,⁵ followed by the first Proposed Plan, issued in January 1992. That

⁴ The Upper Estuary is now commonly referred to as the Upper Harbor. We shall use the latter term in the balance of these comments.

⁵ The August 1990 *Draft Final Feasibility Study of Remedial Alternatives for the Estuary and Lower Harbor/Bay, New Bedford Harbor, Massachusetts* (hereinafter “1990 FS”) remains the most current FS for OU1 (except for the feasibility study that served as the basis for the May 1992 Proposed Plan Addendum, the scope of which was limited to evaluating remedial alternatives for areas in Upper Buzzards Bay).



plan proposed dredging New Bedford Harbor and salt marsh sediment which exceeded PCB concentrations of 50 ppm and 500 ppm respectively, a total of approximately 300,000 cubic yards ("cy"), and disposal of this sediment in three confined disposal facilities ("CDFs") sited along the banks of the harbor. The cost for this remedy was estimated to be approximately \$33,000,000. After receiving comments on this plan, it took EPA until October 1996 to take the next step, when it made public a second Proposed Plan which changed the cleanup levels for sediments in the Upper Harbor and salt marshes from 50 ppm to 10 ppm and 500 ppm to 50 ppm, respectively. This had the effect of increasing the volume of sediments to be dredged to 450,000 cy, increasing the number of CDFs needed for disposal to four, and increasing the estimated cost for the remedy to \$116,000,000.⁶ Almost seven years after the first Proposed Plan for OU1 was made available for public review, ROD 2 was issued in 1998 specifying that approximately 450,000 cy of sediments would be dredged and disposed on site in four CDFs, three in the Upper Harbor and one in the Lower Harbor. The estimated present value cost was \$120-130 million. The CDFs proposed in ROD 2 have not been constructed and, as discussed further below, are unlikely to ever be constructed.

In September 2001, based upon additional site information, EPA issued an ESD for OU1 ("ESD #1").⁷ ESD #1 modified ROD 2 by including additional intertidal areas in the Upper Harbor, deciding to mechanically dewater sediments, changing the wall design of CDF D, and including construction of rail to CDF D to serve a variety of purposes including "as an off-site disposal contingency in case the overall volume of sediments to be disposed exceeds the built capacity of the CDFs."⁸

Less than a year later, in August 2002, EPA issued another ESD ("ESD #2") which provided for the abandonment of CDF D and in its place the transportation of the sediments originally slated for CDF D to an off-site licensed landfill.⁹ EPA also stated in ESD #2 that CDFs A, B and C would be further evaluated, and intimated that they might be abandoned at a later time if doing so was more cost-effective.

⁶ In contrast with the January 1992 Proposed Plan and the May 1992 Proposed Plan Addendum, which provided, on an alternative-by-alternative basis, specific details including the estimated time to complete the necessary work, as guidance requires, the 1996 Proposed Plan does not specify time periods to complete the proposed work. The role of time as a consideration in remedy selection, as well as applicable guidance, is discussed further in Section III.C. below.

⁷ "Additional investigations performed since the ROD, including field surveys, sediment sampling and a state-of-the-art dredging field test conducted in August 2000, have yielded significant new information pertaining to the harbor cleanup." ESD #1 at 4-5.

⁸ ESD #1 at 9. EPA goes on to explain that "[t]his could be an important consideration since computer modeling of the total *in situ* sediment volume needing disposal indicates a worst case total of up to approximately 800,000 cy" (emphasis in original). *Id.*

⁹ This, as modified by ESD #3, is the "existing official remedy."



On March 4, 2010, EPA issued another ESD (ESD #3) to waive the requirements of 310 CMR 30.612, a Massachusetts applicable or relevant and appropriate requirement (“ARAR”) relating to the continued storage of sediments in a cell at Sawyer Street that has a single rather than a double liner. Repeating the theme of drawn-out decision making, ESD #3 concludes, “This ESD documents EPA’s decision to temporarily store contaminated sediment in a manner protective of human health and the environment while alternative disposal options are explored.”¹⁰

With ESD #4, EPA now has decided that it would be more cost-effective to dispose of some of the sediments from OU1 in an in-harbor CAD cell. While this decision might appear to be consistent with a commitment to look for new approaches to achieve a more cost-effective yet still protective alternative for site remediation, this disposal alternative has been considered for use at the Site since 1984 and available since 1989 when the U.S. Army Corps of Engineers (“USACE”) found that the use of CAD cells was technologically feasible for New Bedford Harbor sediments and, in fact, had advantages over the use of shore-based CDFs because contaminants are disposed in a “geochemically stable” underwater environment.¹¹

Moreover, it is a virtual certainty that EPA will abandon the concept of constructing and using CDFs A, B and C.¹² During the June 24, 2010 New Bedford Harbor public update meeting, the public was told that another decision document to abandon the remaining CDFs would be forthcoming in the next “year or two.”

In summary, for the Hot Spot sediments, EPA selected an on-site treatment remedy (incineration), abandoned that idea, spent seven years and millions of dollars evaluating other on-site treatment alternatives, and eventually decided to ship the Hot Spot sediments off site to a licensed landfill. With the OU1 sediments, EPA selected an alternative that included on-site disposal in shoreline CDFs, switched directions and abandoned CDF D (and, as we expect to hear in the future, the rest of the CDFs), and decided to ship the sediments off site. Now, irrespective of the “existing official remedy,” EPA is proposing to dispose of approximately 40% of the remaining contaminated sediments in a CAD cell while approximately 60%¹³ have been or are likely to be shipped off site. The remarkable result is that not one element of ROD 2’s disposal strategy remains in place,¹⁴ ESD #2 effectively will have been rescinded, and EPA

¹⁰ ESD #3 at 7.

¹¹ USACE, 1989, *New Bedford Harbor Superfund Project, Acushnet River Estuary Engineering Feasibility Study of Dredging and Dredged Material Disposal Alternatives, Report 12: Executive Summary* (hereinafter “EFS Report 12”), at 35.

¹² As early as 2002, EPA’s revised cost estimate in ESD #2 for the OU1 remedy did not include costs for the three CDFs. See AVX April 10, 2002 comment letter, fn. 8.

¹³ Volume percentage calculations based on ESD #4 Cost Estimates (as hereinafter defined), Figure 1.

¹⁴ As was also the case for the disposal strategies for OU2, which led to a ROD Amendment.



has yet to consider any of these changes so fundamental as to make it necessary to issue a ROD amendment.

EPA's track record of routinely changing its mind and incrementally modifying the remedy provides little comfort that this latest incarnation of the OU1 remedy is the final version or even something likely to be implemented in the form presented. Nor can there be any confidence that the estimated cost today is anywhere near what the OU1 remedy will ultimately cost. Considerably more than OU1's disposal strategy has changed. See Section III. below for a discussion of the history of changes to volume, cost and project duration.

Further, as discussed in Section II. below, the process leading up to ESD #4 is flawed. In 2006, EPA evaluated the feasibility of two CAD cells in the Upper Harbor,¹⁵ but apparently rejected that idea in favor of a single CAD cell either in the Upper Harbor or Lower Harbor,¹⁶ and now is promoting the idea of one Lower Harbor CAD cell. All this has been done with a bare minimum of explanation or justification.¹⁷

II. ESD #4 – SETTING THE RECORD STRAIGHT.

A. CAD Cells Have Been a Proven Technology for Years.

ESD #4 states that CAD cell technology is a “recognized, protective contaminated sediment disposal approach.”¹⁸ While EPA implies, however, that this technology has only recently reached the point where its use could seriously be considered, the potential use of CAD cells for disposal of New Bedford Harbor sediments has a long history dating back to the early 1980s. The record of its previous consideration and evaluation is on the one hand substantial, and on the other hand disappointing, as EPA never provides a clear record explaining why it rejected the use of CAD cells, not once but at least twice. As Dr. Engler, an internationally-recognized expert in the management of contaminated sediments and for three decades one of the leading sediment scientists at the Army Corp of Engineers Waterways Experiment Station, comments, “CAD technology is basically unchanged from the 1980s to present time and could easily have been applied in New Bedford Harbor at that time with as much success as is experienced today.” (Dr. Engler's comments in full are attached as Attachment 2.)

¹⁵ See USACE, New England District. December, 2006. *Technical Memorandum, Preliminary CAD Cell Volume Capacity Analysis, New Bedford Harbor Remedial Action, New Bedford Harbor Superfund Site, New Bedford, MA* (hereinafter “2006 CAD Volume Capacity Analysis”).

¹⁶ EPA Presentation, January 2010, New Bedford Harbor update meeting. Available at <http://www.epa.gov/region01/nbh/pdfs/presentations/299745.pdf>.

¹⁷ See discussion regarding the first *Five-Year Review Report* in Section IV.A. below.

¹⁸ ESD #4 at 7.



1. 1980s Remedial Alternative Analyses.

NUS, one of EPA's initial contractors for New Bedford Harbor, assessed the use of in-harbor subsurface, i.e., CAD, cells in 1984 as part of the *Addendum to the Draft Feasibility Study of Remedial Action Alternatives*.¹⁹ The CAD cell disposal option was evaluated in response to comments from regulatory agencies that in-harbor disposal should be included as a remedial option. The NUS-proposed CAD cell alternative included five CAD cells, each with a capacity of 200,000 cy. This study concluded that CAD cells would be a viable alternative that would have fewer adverse environmental effects, have low risk of failure provided they were properly engineered, and would be less expensive than many of the other remedial alternatives.²⁰ In addition, the report concluded that this alternative would have fewer adverse effects to adjacent communities.

The use of CAD cells was subsequently evaluated by the USACE as part of the *New Bedford Harbor Engineering Feasibility Study ("EFS")*²¹ in 1989. The criteria used for evaluating the implementability and technical effectiveness of CAD cells were threefold:

- the material can be placed and capped within available areas;
- the capping thickness required for long-term isolation of the contaminated sediments could be placed and maintained successfully; and
- estimated contaminant releases downstream of the Coggeshall Street Bridge were within EPA established criteria.

As discussed in the *EFS*,²² as well as in Truitt (1987),²³ CAD cells had been successfully used in several places by 1987 including in Rotterdam Harbor, the Netherlands,

¹⁹ NUS. 1984. *Addendum Draft Feasibility Study of Remedial Alternatives*, Acushnet River above Coggeshall Street Bridge, New Bedford Harbor Site, Bristol County, Massachusetts.

²⁰ In 2010, in ESD #4 EPA justifies the CAD option by the fact that recent studies affirm that use of CAD cells is not a potential problem at New Bedford Harbor. Yet, NUS came to the same conclusion 26 years earlier: "The greatest potential consequence of pumping the contaminated and clean sediments back into the subsurface cells is the resuspension and dispersion of pumped materials to areas outside the cells. The potential for a significant effect is small, however." *Id.* at 2-25.

²¹ D.E. Averett, M.R. Palermo, M.J. Otis and P.B. Rubinoff. 1989. *New Bedford Harbor Superfund Project, Acushnet River Estuary Engineering Feasibility Study of Dredging and Dredged Material Disposal Alternatives; Report 11, Evaluation of Conceptual Dredging and Disposal Alternatives*. Technical Report EL-88-15, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS (hereinafter "*EFS Report 11*").

²² "Contained aquatic disposal is similar to level-bottom capping but with the additional provision of some form of lateral confinement to minimize spread of the materials. Level-bottom capping may be defined as the placement of a contaminated material at an open-water disposal site on the bottom in a mounded configuration and the subsequent covering of the mound with clean sediment. Level-bottom capping is a dredged material



for placement of highly contaminated sediments, and had been demonstrated or proposed for a variety of disposal conditions. Attachment 3 provides summary-level information regarding several CAD cell projects implemented in the 1980s and early 1990s.²⁴ These early CAD projects as well as many others are also summarized in the comments of Dr. Engler.²⁵

The *EFS* concluded that use of CAD cells was feasible for New Bedford Harbor sediments and, in fact, had advantages over use of shore-based CDFs because contaminants are disposed in a “geochemically stable” underwater environment.²⁶ The evaluation also concluded that CAD cell options may be less expensive than CDF options.²⁷

The USACE conducted a pilot study of disposal alternatives in 1988 as part of the *EFS*. This pilot project consisted of disposing approximately 2,500 cy in the area which had been dredged as part of the pilot dredging project, and then capping that 2,500 cy with another 2,500 cy of clean sediment. The USACE pilot study of contaminated sediment disposal in a CAD cell determined that elevated suspended sediment and contaminant concentrations in the vicinity of the disposal operation existed. However, with the exception of one sampling event, contaminant concentrations detected at the Coggeshall Street Bridge were reported as statistically insignificant. Lessons learned from the pilot study included the need for a silt curtain around the CAD cell disposal area and the need for a delay period between filling and capping the CAD cells to allow for natural consolidation of the contaminated sediment. As

disposal alternative routinely used in the US Army Engineer (USAE) Division, New England (Morton, Parker, and Richmond 1984; Truitt 1987a). The CAD alternative has been successfully used in Rotterdam Harbor, the Netherlands, for the placement of highly contaminated sediments (d’Angremond, de Jong, and de Waaard 1986) and has been demonstrated or proposed for a variety of disposal conditions (Truitt 1986, Environmental Laboratory 1987, Palermo et al. 1989).” *EFS Report 11*, ¶ 109.

²³ Truitt, C.L. 1987. *Engineering Considerations for Capping Subaqueous Dredged Material Deposits – Background and Preliminary Planning*. USACE Technical Notes. EEDP-01-3.

²⁴ The material in Attachment 3 is taken from Palmerton, D.L. 2003. *Contained Aquatic Disposal (CAD) – A Review of Monitoring Programs*. 2nd International Symposium on Contaminated Sediments. 218-223.

²⁵ Dr. Engler states that as of 2006, the last time these data have been compiled in such comprehensive form, capping of contaminated dredged material in aquatic sites, which began in the 1970s, and capping for remediation and dredged material disposal, has been conducted at over 100 projects world-wide and over 80 projects in the U.S. Of these projects, approximately 20 utilized CAD cells.

²⁶ “Monitoring of capped sites for other projects dealing with contaminated dredged material has not indicated any significant potential for long-term migration of contaminants upward through the cap. Uncertainties for the CAD cells evaluated for New Bedford are associated with ground-water flow upward through the cap, erosion of the cap by extreme storm events, or breaching of the cap by deep-burrowing organisms currently not active in this area. Monitoring of the physical integrity of the cap and contaminant movement through the cap will provide warning of the need for remedial action. Additional capping material (thickness constrained by mean low water elevation) can be added if the need arises. If the effectiveness of the cap is maintained, the reliability of the CAD alternative in containing contaminants is expected to be good.” *EFS Report 11*, ¶ 195.

²⁷ *EFS Report 12* at 35.



indicated in Dr. Engler's comments, these procedures are operational issues related to disposal methods and operator skills that could have been readily addressed.²⁸ These observations are not related to whether a CAD cell is technologically effective or not.²⁹ Based on the pilot study, CAD cell technology was retained as a potential remedial alternative.

2. CAD Technology Inexplicably Abandoned in 1990.

Volume II of the *1990 FS* included use of a single deep CAD cell for Upper Harbor sediments as a separate remedial alternative to CDFs.³⁰ The evaluation, however, dropped this as a separate remedial alternative, citing the USACE's determination that much of the Upper Harbor was unsuitable for CAD cells and due to a lack of space, i.e., nearly all available shoreline and island CDF space would be needed to temporarily store the clean sediment while the CAD cells were filled with contaminated sediments. However, the use of CAD cells was retained as a technology that could be incorporated into the shoreline and island CDF disposal alternatives (EST-3 and EST-4). The proposed location for CAD cells is mentioned in the text, but potential CAD cells are not shown on the accompanying figures which only identify proposed CDF locations. In addition, the comparison of remedial alternatives does not mention CAD cells as a potential disposal option.

Volume III of the *1990 FS* proposed three site-wide alternatives, none of which included CAD cells as a disposal alternative. The summary of remedial options in ROD 2 for on-site disposal alternatives (Alternatives EST-3/LHB-3 and EST-4/LHB-4) does not even mention that the use of CAD cells was evaluated as a disposal option.

²⁸ Dr. Engler's conclusion is borne out by EPA's draft Clean Water Act determination found in ESD #4, which finds that best management practices can control short-term impacts from construction of the LHCC and from dredging and placement of contaminated sediment in the LHCC. ESD #4 at 14, pars. 5 and 6.

²⁹ AVX and four other potentially responsible parties ("PRPs") made similar observations in comments submitted on the pilot dredging program. We quote in relevant part: "In addition, the design of the CAD calls for the CAD to be covered with a 2 foot thick cap of dredged material. Contaminated dredged sediments will exit from the dredge in a liquid slurry, initially having little shear strength. How long will the USACE wait for the contaminated materials to consolidate and gain strength before capping? Is it expected that up to 91% silt and clay sediments will quickly consolidate into even a soft soil? If the underlying contaminated sediments are not given sufficient time to consolidate, there may be unacceptable mixing during the placement of capping material, with potential to leave contaminated soils at the surface." *Comments on the New Bedford Harbor Pilot Dredging Program*, submitted by AVX, et al., undated, document # 53641 in *New Bedford Harbor Superfund Site Administrative Record for Record of Decision Operable Unit 2 – Hot Spot (1990 Hot Spot ROD) Index* at 131.

³⁰ *1990 FS*, Volume II, at 6-23.



3. CAD Cells Revived.

The administrative record file ("AR") for ESD #4 as presently proposed includes documents dated December 15, 2009 through June 23, 2010.³¹ But a review of both the limited information available in the public record and, more importantly, information AVX obtained through its July 28, 2010 FOIA request (copy attached as Attachment 4), shows that the picture presented by ESD #4 and the current AR supporting it, present a selective account of how EPA reached the present point in time.³²

As a result of its FOIA request, AVX has now learned that for over five years, faced with looming budget increases and uncertain funding, EPA has been conducting an *ad hoc* evaluation of less expensive alternatives to the current ROD 2 remedy (as modified by three ESDs) of disposing some sediments off site and filling CDFs A, B and C.³³ The FOIA documents clearly reveal EPA's objective has been to revise the FS and then amend ROD 2.³⁴ The goal of a ROD amendment is first mentioned in 2005,³⁵ at that time with a target date of 2008, which was later revised to 2009, and then 2010.³⁶

The alternatives EPA has evaluated over the last five years have included:

- 100% off-site disposal;
- fill one Lower Harbor CAD cell and three CDFs, interim on-site disposal;
- fill one CAD cell, take the remainder off site (hybrid);
- use two CAD cells, one in the Lower Harbor and one in the Upper Harbor, or alternatively, two CAD cells in the Upper Harbor, interim off-site disposal; and

³¹ There is one exception: October 15, 2003 *Final Environmental Impact Report (FEIR) for New Bedford and Fairhaven, Dredged Material Management Plan (DMMP)*, EOE No. 11669. Clearly, EPA did not author this document. Further, we presume EPA consulted it only after the decision to pursue use of CAD cells.

³² In particular, AVX asks why the AR does not include the 2006 *CAD Volume Capacity Analysis* and the August 2005 memorandum entitled *Draft Internal Remedy Review and Alternatives Analysis, New Bedford Harbor Superfund Site* (which memorandum is Appendix C to the 2006 *CAD Volume Capacity Analysis*) ("2005 EPA Memo").

³³ It appears that the impetus towards the reworking of the remedy arose in late 2004. See EPAFOIA000422-25 (included in Attachment 1).

³⁴ Minutes of an Internal Remedy Review & Alternatives Analysis Planning Meeting held on February 16, 2006 state that the FS revision must be completed by fall 2007 in order to complete the ROD amendment by early 2008. See EPAFOIA000413 (included in Attachment 1).

³⁵ See 2005 EPA Memo at 2.

³⁶ See, e.g., EPAFOIA000229-30 [2010], EPAFOIA000267 [2009], and EPAFOIA000413-18 [2008] (included in Attachment 1).



- some off-site disposal combined with sub-aqueous capping of large portions of the Upper Harbor).³⁷

This new information provides the context for the *2006 CAD Volume Capacity Analysis* in which the USACE and its contractors evaluated the alternative of disposing all dredged sediments into two CAD cells in the Upper Harbor.³⁸ The basis of this analysis included one proposed CAD cell located in Pierce Mill Cove,³⁹ the other in an unnamed cove on the Fairhaven side of the harbor north of the Coggeshall Street Bridge. The report concluded that the two proposed CAD cells would provide adequate capacity to handle the approximately 800,000 cy of targeted sediments from both the Lower Harbor and Upper Harbor, the estimate at that time.

As best AVX can determine, the first time EPA informed the public that CADs were being considered as an alternative OU1 remedy was on October 30, 2008, when EPA made a presentation at the monthly update meeting in New Bedford that included the slide (Slide 54) attached as Attachment 5, which showed two potential locations for a CAD cell, one in the Lower Harbor north of Popes Island, the other in the Upper Harbor in Pierce Mill Cove, and indicated use of a CAD cell was still in the evaluation phase. Even with that disclaimer, the presentation included a slide regarding “anticipated schedule for public comment and decision

³⁷ AVX has been long a proponent of remedial alternatives that focus on in-harbor management of contaminated sediment. Following the *Fast Track Feasibility Study* in 1985, when it became clear that EPA was advocating removing all impacted sediments from the harbor, AVX has been critical of remedial alternatives that proposed dredging and treating the sediments or dredging them only to dispose of them in large, costly CDFs lining the harbor or off site. In 1988, AVX commissioned its own experts to come up with a viable, environmentally protective and cost-effective remedial action plan. This comprehensive plan, which was delivered to EPA in October 1989, proposed sub-aqueous capping of all sediments in the Upper Harbor. See Balsam Environmental Consultants, Inc., October 1989, *A Remedial Action Program, New Bedford Harbor Superfund Site*. Since then, EPA has had its own successful experience with capping of the contaminated sediments in the vicinity of the Cornell-Dubilier Electronics, Inc. facility outside the Hurricane Barrier.

Interestingly, while EPA dismissed this plan at the time as being infeasible, it had many elements in common with the CAD alternative, including: (1) New Bedford Harbor remains the ultimate repository for impacted sediments; (2) a cap of clean sand, perhaps augmented with an active adsorbing material such as activated carbon, would be adequate to prevent migration into the overlying water; and (3) placement of the cap could be carefully controlled to minimize resuspension and dispersion of contaminants.

³⁸ At EPA's request, the USACE forwarded the *2006 CAD Volume Capacity Analysis* to URS on August 11, 2008. The pdf of the document did not include appendices B, C and D. Following the publication of ESD #4, the appendices were noted as missing in the process of reviewing materials to be used to prepare comments on ESD #4 on behalf of AVX. Following AVX's request, EPA forwarded the appendices on July 23, 2010.

³⁹ Pierce Mill Cove is located on the New Bedford side of the harbor to the north of the USACE facility on Sawyer Street.



documents for any changes to the harbor cleanup: Fall 2009 for potential Lower Harbor CAD cell; Fall 2010 for potential Upper Harbor CAD cell.⁴⁰

In a fashion similar to the *1990 FS*, when the use of CAD cells was dropped from consideration with little, if any, explanation, EPA has, once again, proceeded through a decision-making process lacking transparency. While EPA has presented information in ESD #4 on the environmental protectiveness, technical efficacy and cost-effectiveness of CAD cells, it has issued a draft ESD which fails to explain why EPA has decided to construct only one CAD cell to handle less than half the targeted sediments, part of a combined remedy that would cost about \$422,000,000 (fully-funded),⁴¹ over \$70 million more than the cost for dredging and disposing all sediments into the two CAD cells contemplated in the *2006 CAD Volume Capacity Analysis*, based upon preliminary estimates.⁴²

In proposing the LHCC and scheduling it to be filled with Lower Harbor sediments before the remainder of the Upper Harbor is dredged, EPA also is deviating from its previous priority of addressing the most highly contaminated sediments first, and doing so without providing a word of explanation for why EPA deems it necessary. Most strikingly, EPA has not been fully candid with the public, including PRPs like AVX, as to the extent to which it engaged in a broader analysis of options or why its remedial decision-making proceeded as it did. In 2004, EPA embarked on a course of action that resulted in obvious and fundamental changes in costs, volume and project duration to the “existing official remedy.” The legal implications of that course of action are analyzed below.

B. EPA’s Cost Estimates Should Be Carefully Reviewed.

1. General Comments on Cost Estimates.

EPA has provided the cost backup for ESD #4 in a 136-page document which the administrative record file dates June 21, 2010 and refers to as *Cost Estimates for 2010 Confined Aquatic Disposal (CAD) Cell Explanation of Significant Differences (ESD)* (“ESD #4 Cost Estimates”). The first page of the ESD #4 Cost Estimates states at its top “Assumptions for ESD Cost Estimates.” Pages 1-3 present 14 numbered “general” assumptions. The first assumption underlying the cost backup (“Assumption #1”) is that the cost estimates for ESD #4 were prepared following EPA’s guidance document, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, EPA 540-R-00-002, OSWER 9355.0-75, July

⁴⁰ See October 30, 2008 Public Meeting. Available at <http://www.epa.gov/region01/nbh/pdfs/presentations/293637.pdf>, slide #56.

⁴¹ Costs are cited as cost to complete assuming \$80,000,000 per year annual funding.

⁴² See EPAFOIA000178 (included in Attachment 1).



2000 (*Cost Guidance*).⁴³ Assumption #1 further states that the estimates provided in the ESD, consistent with EPA guidance, are expected to be accurate within the range of -30% to +50% of the actual project cost.⁴⁴

There are at least two things wrong with Assumption #1. First, the implication is that EPA's present estimates would pass muster even if the ultimate cost of the OU1 remedy was as much as \$2.9 billion (fully-funded).⁴⁵ This is staggering considering that according to ESD #1 and corroborated by ESD #2, the estimated cost of the ROD 2 remedy was \$188,000,000 (fully-funded).⁴⁶ It would mean that actual project costs *more than 15 times* ROD 2's projected costs are acceptable.

Second, the -30% to +50% accuracy range has been misinterpreted and misapplied. The *Cost Guidance* sets forth the following:

- Cost estimates are developed at different stages of the Superfund process.⁴⁷
- Cost estimates are prepared during the FS primarily for the purpose of comparing remedial alternatives during the remedy selection process.⁴⁸
- The expected accuracy of cost estimates during the FS is less than that of estimates developed during later stages of the Superfund process.⁴⁹
- The expected accuracy range of cost estimates during the FS "screening of alternatives" is -50% to +100%, and during the FS "detailed analysis of alternatives," it is -30% to +50%.⁵⁰

⁴³ Available at <http://www.epa.gov/superfund/policy/remedy/pdfs/finaldoc.pdf>.

⁴⁴ Assumption #1 correctly states that estimates at the FS stage are expected to be accurate within the range of -30% to +50% of actual project cost. This contrasts with EPA's prior practice of using the standard to compare a revised estimate with an earlier estimate. See, e.g., ESD #1 at 10-11 and ESD #2 at 9 (remedy as modified within acceptable range of original ROD cost estimate). The cost accuracy range standard is a gauge of the quality of the estimates, but it is not an imprimatur as to compliance with the NCP. Its use is suitable for remedy comparison and selection, not to compare revised estimates with prior estimates.

⁴⁵ The calculation is as follows: (1) 150% of \$1.7 billion (the estimated fully-funded cost for the current remedy with \$15 million annual funding) is \$2.55 billion; (2) plus approximately \$350 million of past costs for OU1; (3) yields a total of \$2.9 billion.

⁴⁶ ESD #1 at 10; ESD #2 at 9.

⁴⁷ *Cost Guidance* at 1-2.

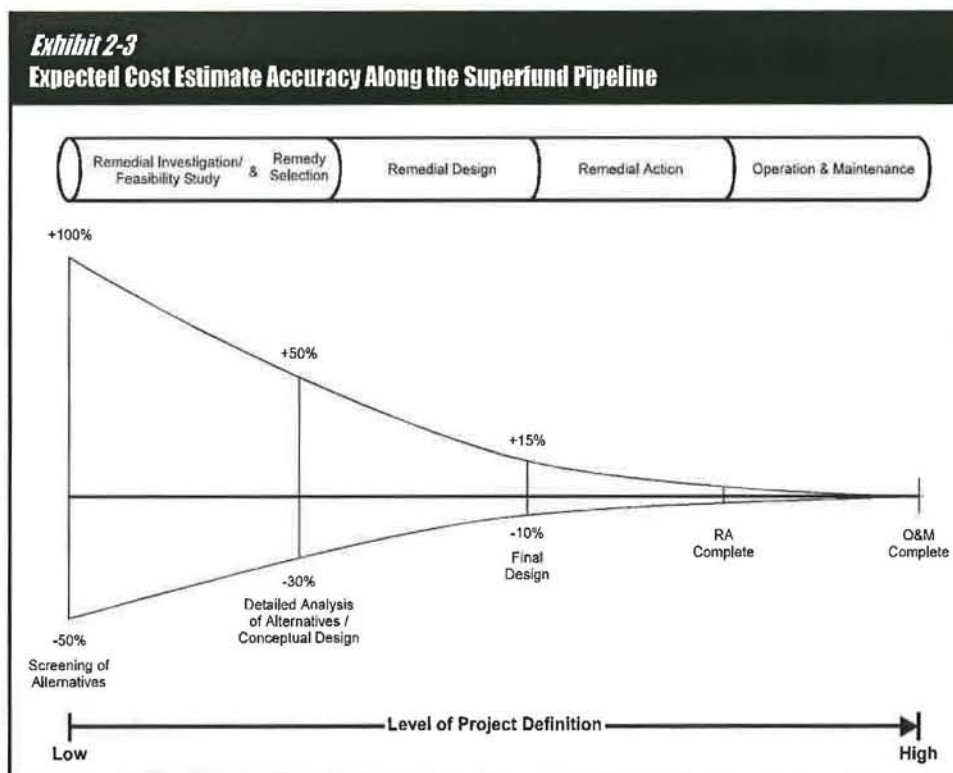
⁴⁸ *Id.*

⁴⁹ *Id.* at 2-4.

⁵⁰ *Id.*



- As depicted in Exhibit 2-3 of the *Cost Guidance* (inserted immediately below), the expected cost estimate accuracy increases after the FS is completed. For example, by the time a remedy reaches the final stage of the remedial design, the accuracy range is -10% to +15%.



Thus, while the -30% to +50% accuracy range may be acceptable at the FS stage, not so when a project is further down the “Superfund pipeline.” With the arguable exception of one element of ESD #4, the construction of the CAD cell, EPA is well beyond the FS stage. EPA has been dredging, treating, transporting and disposing OU1 sediments for over seven years. Even with regard to CAD cell construction, EPA has made several presentations over many years indicating how closely EPA has been working with the New Bedford Harbor Development Commission and other state enhanced remedy stakeholders. It is neither credible nor acceptable to have so much uncertainty in estimating the cost of the LHCC given that some CAD cells have already been constructed in New Bedford Harbor and EPA has access to all relevant cost information.

2. Specific Comments on Cost Estimates.

URS performed a sample audit on the fixed cost summary and backup tables provided by EPA in the ESD #4 Cost Estimates, and found that the cost summary tables do not always



agree with the cost backup tables for the various alternatives. As an example, there is an error in "Alternative #2, \$80 million a year for 6 years." The summary (page 1 of 12) states there is a total of \$63,981,882 in fixed costs; however, the fixed cost items on the backup table (pages 2, 3 and 4 of 12) only total \$44,538,131. That and other discrepancies noted in a subsampling are listed in the following table:

Alternative	Summary Sheet Fixed Costs	Backup Sheet Fixed Cost	URS Total
Alt#2 80m 6 years	\$63,981,882	\$63,981,882	\$44,538,131
Alt#1 80m 7 years	\$76,320,537	\$67,325,174	\$52,037,266
Alt#2 15m 40 years	\$234,680,854	\$234,680,854	\$135,196,137
Alt#2 30m 25 years	\$170,882,834	\$170,882,834	\$98,542,653

The discovery of these cost calculation errors for fixed cost requires that a full review of the cost alternatives be examined for thoroughness by EPA and its consultants. To the extent that there are errors in these cost estimates, it will be reflected in calculations of net present value ("NPV") for the corresponding alternatives.

Although general assumption #4 in the ESD #4 Cost Estimates indicates that "The fixed costs used in the cost estimates are based on actual values experienced at the site during remedy implementation to date," the vast majority of the costs for both alternatives are actually based upon only one year's experience (2008 actual costs). AVX is concerned that use of only one year's cost experience may bias these estimates, since EPA has offered no evidence that 2008 was a representative year for all resources, manpower, equipment use and activities. In particular:

- The 2008 actual cost data developed as the basis for ESD #4 did not state in the narrative if any of the activities or events from the 2008 actual cost data had premium time for summarized activities. The use of premium time for any direct or indirect cost would inflate the overall cost for the activity.
- It is unclear whether the 2008 actual cost data used for ESD #4 may include work items that were not performed during the 2008 period. It is uncertain how these line items were forecast and on what basis since the backup tables state that 2008 escalated cost information was used.
- The cost estimate for ESD #4 has not provided supporting detailed documentation for the breakdown of the resources, manpower, and equipment and cost.



- The cost numbers presented in the backup tables show some work elements will be performed for several consecutive years. The estimated costs for consecutive years of work provide only consistency in the calculation of quantity to unit cost, but do not provide any accounting for increases and decreases in productivity from year to year due to weather, maintenance problems, etc. In other words, it is an ideal, rather than a realistic, budget based upon unchanging assumptions.
- The 2008 actual cost data apparently was escalated for the ESD #4 cost estimates, and the narrative assumption states “when possible, actual cost from similar activities have been used to derive estimated costs.” This approach results in substantial uncertainty since the means and methods for this type of contaminant removal could vary dramatically in area, manpower, equipment, and in fixed cost.

Finally, in comparing the cost estimates for Alternative 2 in ESD #4 to the documents released after our FOIA request, we note that in the six months preceding the release of ESD #4, EPA has unaccountably increased the estimated budget for Alternative 2 by as much as 17% for the \$80M/yr rate. In a January 19, 2010 memorandum from Jacobs Engineering to EPA, the estimate for the “hybrid” alternative using one CAD cell, essentially ESD #4, was \$335 million (NPV).⁵¹ In ESD #4, the estimate for this same option is \$393 million (NPV), a difference of \$58 million or 17%. There is no documentation to account for this large increase.

C. Particular Portions of EPA’s Draft Determinations Should Be Reviewed and Revised.

In ESD #4, EPA specifically seeks public comment on (1) a draft finding under the Clean Water Act that the siting, construction, filling, and long-term operation and maintenance of the proposed LHCC represents the least damaging practical alternative to addressing potential impacts from PCB-contaminated sediments to wetlands and aquatic habits within the New Bedford Harbor, and (2) a draft risk-based finding under the Toxic Substances Control Act that the permanent disposal of PCB-contaminated sediment into the LHCC will not pose an unreasonable risk of injury to health or the environment.⁵² AVX has one comment with respect to each draft determination.

Clean Water Act. The second of eight findings that serve as the basis for EPA’s determination states: “CAD cells are a proven technology for sequestering contaminated sediments, although the levels of PCBs within the Superfund sediments to be disposed of are

⁵¹ See EPAFOIA000002 (included in [Attachment 1](#)).

⁵² ESD #4 at 2-3.



higher than other sites where CAD cells have been used.”⁵³ The second part of this sentence is misleading. AVX refers EPA to the following statements from Dr. Engler’s comments:

[T]he thickness of the cap is driven by the following three elements: contaminant isolation, depth of bioturbation, and surface stability. The concentration and mobility of the chemicals of concern are important to the designed thickness of a cap where *even the most heavily contaminated sites can be adequately contained* (emphasis added).⁵⁴

Capping of sediments has been successful at several sites grossly contaminated by wood treatment wastes which have NAPL (non-aqueous phase liquids-chemical fluids) in the sediment in combination with PAHs, creosote, and PCB, or other contaminants. Such sites technically are far more complex than the New Bedford Harbor contaminants.⁵⁵

The first statement establishes that CAD technology has been proven adequate to containing sediments irrespective of the levels of contamination. The second statement rebuts EPA’s assertion that New Bedford Harbor sediments are more contaminated than previously placed into a CAD cell.

While EPA’s assertion may be partially correct if it is narrowly interpreted to mean that the *in situ* concentration of New Bedford Harbor PCBs are higher than other sites where CAD cells have been used for PCB disposal,⁵⁶ the statement is misleading because it implies (1) the PCB concentration in the sediments to be disposed in the CAD cell are extraordinarily high; and (2) that it is technologically difficult to design an effective cap for sediments with a relatively high concentration of PCBs.

Sediments capped in a CAD cell will not be at *in situ* concentrations. They will be at far lower concentrations as a result of the dredge process. Even the mechanical dredging process, as is envisioned for removing sediments for placement in the LHCC, mixes the sediments, first when placing them in a hopper barge, and secondly, in the release and settlement process from the hopper barge during placement in the CAD cell. As a result, the concentrations of PCBs in sediments coming to rest in the CAD cell would have been

⁵³ *Id.* at 14.

⁵⁴ Attachment 2 at 3.

⁵⁵ *Id.* at 6.

⁵⁶ AVX has not independently verified the truth of this statement, but notes that at the August 26, 2010 public meeting in New Bedford, EPA said that the Puget Sound CAD cell, about which information had been presented, was used for disposal of sediments with PCB concentrations similar to the New Bedford Harbor cleanup levels.



“averaged out” by the relatively clean sediments from over-dredging that are mixed in, as well as from the dynamics of the dredging process.

As indicated by Dr. Engler, the design of the cap that will be placed on the CAD cell provides for sufficient thickness so that the contaminated sediments are isolated from bioturbation which potentially is the foremost transport mechanism within the near surface sediment bed.⁵⁷ Once the contaminated sediments in the CAD cell are isolated from bioturbation by a cap, the primary transport mechanism for PCBs in sediment under the CAD cap would be molecular diffusion which depends upon the chemical gradients of PCB in pore water. Because PCBs have high partitioning coefficients, they are strongly sorbed to sediment particles, particularly in a sediment environment characterized by high levels of organic carbon as in New Bedford Harbor sediments. Sediment-sorbed PCBs are not directly available for diffusion. Only that amount of the sediment-sorbed PCB which dissolves in the pore water is available for diffusion. Since the solubility of PCBs is very low (in the low parts per billion), very little gets into the pore water and hence very little is available for diffusion. Thus, it is the dissolved PCBs which limit the potential for transport through the cap and not the absolute bulk sediment concentration. In studies supporting the proposed remedial action plan AVX submitted to EPA in October 1989,⁵⁸ Thibodeaux concluded that the breakthrough time for PCBs under a 45 cm cap was over 1,000 years and, even after breakthrough, the PCB flux was estimated to be less than 3,000 grams per year over a 140-acre cap.⁵⁹ Based upon this result, PCB flux through the cap of a 3-4 acre CAD cell would be expected to be an order of magnitude less and only after 1,000 years.

Finally, it is technologically more difficult to design a cap for sediments contaminated with NAPL and wood waste or coal tar-associated volatile organic compounds such as are found at some of the sites noted by Dr. Engler. In these sediments, microbial metabolism can lead to ebullition (release of gas bubbles) which would facilitate transport of contaminants through the cap. Thus, design of an effective cap for the proposed LHCC is well within the state of the practice in management and disposal of sediments contaminated with PCBs.

Toxic Substances Control Act. On page 15 of ESD #4, EPA states that it has made a draft finding that the construction and disposal of PCB-contaminated sediment into a CAD cell “will not pose an unreasonable risk of injury to health or the environment as long as certain

⁵⁷ Bosworth, W.S., and L.J. Thibodeaux. 1990. Bioturbation: A Facilitator of Contaminant Transport in Bed Sediment. *Environmental Progress*. 9(4): 211-217.

⁵⁸ See Balsam Environmental Consultants, Inc., October 1989, *A Remedial Action Program, New Bedford Harbor Superfund Site*.

⁵⁹ The sub-aqueous cap proposed by AVX in 1989 covered much of the Upper Harbor, and was about 140 acres in size. Thibodeaux, Louis J. 1989. A theoretical evaluation of the effectiveness of capping PCB-contaminated New Bedford Harbor sediment. Report to Balsam Environmental Consultants, Inc.



conditions are met.” The draft determination (Attachment B to ESD #4), however, does not meet this standard. The final sentence of the draft determination’s second paragraph states: “Based on the information provided, the ESD’s proposed plan *is believed* to not pose an unreasonable risk of injury to health or the environment” (emphasis added).⁶⁰ EPA’s determination that it *believes* that the use of a CAD cell will not pose risk does not meet the requirement at 40 CFR 761.61(c)(2) for EPA to approve a risk-based cleanup “if it finds that the method *will not* pose an unreasonable risk of injury to health or the environment” (emphasis added).

D. EPA’S Coordination with the State Enhanced Remedy May Be Inconsistent with Sound Remedial Decision-Making.

Under the NCP, EPA may select a state enhanced remedy (“SER”) if it finds that the proposed change or expansion, while not necessary for the selected remedial action, “would not conflict or be inconsistent with the EPA-selected remedy.”⁶¹ As part of ROD 2, EPA approved a SER for navigational dredging and disposal of up to 2 million cy of harbor sediments below the Superfund cleanup levels. As developed over time, a key element of the SER is disposal of most of these navigational dredge spoils in CAD cells located between the Coggeshall Street Bridge to the north and Popes Island to the south. The CAD cell location was selected in accordance with the Massachusetts Environmental Policy Act, and the selection of this area is documented in the 2003 Final Environmental Impact Report for the Dredged Materials Management Plan.

ESD #4, however, has become so intertwined with the SER in several important respects that AVX is concerned that EPA’s decision-making on ESD #4 is impermissibly driven as much by the SER as by the NCP. Some examples of this are discussed below but generally, it appears that at least some of the stakeholders, as well as perhaps EPA, have come to see the various dredging projects in New Bedford Harbor as one single big dredging project. EPA cannot take this view, as it can never lose sight of its particular statutory responsibilities under Superfund. Among other things, EPA must take care that no Superfund money is spent on the SER.⁶²

Mixing sediments from the Superfund cleanup with navigational dredge spoils. ESD #4 envisions both Superfund and navigational sediments potentially may be disposed of in the LHCC. Such mixing could result in cross-contamination of the less contaminated navigational sediments with the more highly contaminated Superfund cleanup sediments, potentially creating

⁶⁰ ESD #4, Attachment B, at 1.

⁶¹ 40 CFR, § 300.515(f).

⁶² See *Reusing Superfund Sites: Recreational Use of Land Above Hazardous Waste Containment Areas*, EPA 540-K-01-002, OSWER 9230.0-93, March 2001, at 16.



a greater volume of sediments that would exceed the original sediment cleanup concentration. This approach is contrary to long-standing EPA policy in several respects. Under the analogous and well-established “mixture rule” of the Resource Conservation and Recovery Act often referred to as RCRA, the mixture of a solid waste with a hazardous waste is itself a hazardous waste.⁶³ Similarly once Superfund dredge spoils and navigational dredge spoils are mixed, they might all end up as hazardous substances which exceed the Superfund cleanup levels.

Section 121 of CERCLA, Cleanup Standards, directs EPA to consider the potential for future remedial action costs if the alternative remedial action in question were to fail.⁶⁴ If ESD #4 is implemented, and there is remedy failure, the sediments requiring action under the Superfund program will have increased over the original volume as a result of mixing. Given EPA’s history of changing directions on this project, this may not be as hypothetical an occurrence as it seems. And the potential for increasing the volume of hazardous substances above cleanup action levels is inconsistent with EPA’s emphasis on reducing mobility, toxicity and volume of hazardous substances. While CERCLA § 121 mentions the preference for reducing mobility, toxicity and volume in connection with remedies that utilize permanent treatment, that preference should still be a guiding principle for all Superfund cleanups.

Location of LHCC. AVX believes that now is the time for EPA to consider building not one but two CAD cells in New Bedford Harbor. Using the previously-approved location for the navigational CAD cells appears to be as much a restriction preventing EPA from immediate consideration of a comprehensive remedy as an advantage. But from what appears on the public record, EPA has explored alternative CAD cell locations since 2003, so EPA appears to believe it can locate one or more Superfund CAD cells in some area of the Harbor other than the State-approved site.

Timetable for LHCC. It appears there is some urgency if EPA is to utilize the CAD cell associated with Phase IV of the navigational dredging project.⁶⁵ This urgency may very well be one of the reasons why EPA is not following the NCP and its own guidance by conducting a focused feasibility study now to determine the most cost-effective way to complete the OU1 cleanup, rather than continue its piecemeal approach of one change at a time. From EPA’s track record to date, incremental changes have not expedited, and will not hasten, the completion of the cleanup.

⁶³ See 40 C.F.R. § 261.3(a)(2)(iv). AVX notes that for certain types of remedial actions, Congress directed EPA to consider the goals, objectives, and requirements of the Solid Waste Disposal Act [RCRA]. See 42 U.S.C. § 9621(b)(1)(B). That EPA should give deference to RCRA policy is reinforced by the fact that M.G.L. Ch. 21C, the Commonwealth’s analog to RCRA, is an ARAR.

⁶⁴ 42 U.S.C. § 9621(b)(1)(F).

⁶⁵ See New Bedford Harbor/Fairhaven Municipal Harbor Plan, 2010, Appendix A, Dredge Management Plan, at 39.



III. FUNDAMENTAL CHANGES TO OU1 REMEDY.

While AVX endorses the modification in ESD #4 to the exceptionally expensive off-site disposal alternative, EPA has not gone far enough. Instead of proposing a comprehensive cost- and time-effective solution, EPA apparently again has elected to take a step-by-step approach to an overall global remedy by issuing an ESD now and waiting an indeterminate amount of time to issue a ROD amendment. Early in these comments, AVX summarized the previous changes to the selected remedy for OU1. Assuming ESD #4 is adopted, a comparison between ROD 2 and what will then be the “existing official remedy”⁶⁶ shows such fundamental changes that under EPA’s own guidance, the time has come for a ROD amendment and the open public process that it guarantees. These fundamental changes are discussed below.

A. Volume.

In spite of over 25 years of study, EPA continues to have a poor handle on exactly how much contaminated sediment needs to be removed. The following table depicts the steady increase in estimated volume:

<i>Document</i>	<i>Date</i>	<i>Volume (cy)</i>
Proposed Plan	Jan 1992	308,000
Proposed Plan Addendum	May 1992	375,000
Proposed Plan	Oct 1996	450,000
ROD 2	Sep 1998	450,000
ESD #1	Sep 2001	472,700
ESD #2	Aug 2002	507,100
Five-Year Review	Sep 2005	880,000
ESD #3	Mar 2010	n/a
ESD #4 (proposed)	Jun 2010	900,000

Decisions made as to the most appropriate remedial alternative continue to be founded on a high level of uncertainty:

- As summarized in ESD #4,⁶⁷ ROD 2 estimated a total of 450,000 cy assuming that another 126,000 cy would not need to be removed because those additional

⁶⁶ Not to mention further changes to eliminate CDFs A, B and C.

⁶⁷ ESD #4 at 1.



contaminated sediments would be buried under the four shoreline CDFs. This yields a total of 576,000 cy if the CDFs were not constructed.

- ESD #1 stated that the total sediment needing removal was 473,000 cy and CDFs A and B potentially were not needed.⁶⁸ At the same time, ESD #1 also stated that EPA had conducted some computer modeling and concluded the estimated total volume of sediment needing removal was a *worst case* (EPA's emphasis) of 800,000 cy.⁶⁹
- In the September 2005 *Five-Year Review Report*, EPA estimated the volume needing removal to be 880,000 cy, 10% greater than the *worst case* estimate calculated just four years before, and nearly 75% more than the estimated volume in ESD #2.⁷⁰
- ESD #4 indicates the estimated volume of sediment needing removal has again increased, this time to 900,000 cy.⁷¹

This consistent trend of increasing volume estimates gives the public little confidence that it can rely on EPA's new volume estimate in ESD #4. Even though the public had a reasonable right to expect that the Site was adequately characterized by 1998, prior to decisions being made on the most cost-effective and environmentally protective remedy in ROD 2, volume is still a moving target after 20+ years since the remedial investigation and feasibility study was concluded and 10 years since EPA conducted the comprehensive study to estimate the volume of sediment needing removal in support of ESD #1. Unfortunately, with every decision document, estimates of volume increase. When volume increases evolve over time, such changes are noted by ESDs to be "significant." In contrast, a doubling of the volume must be regarded as a fundamental change to a remedy and subject to the more rigorous standards triggered by a ROD amendment.⁷²

B. Cost.

EPA now projects potential spending on OU1, without ESD #4, as much as another \$1,700,000,000 (fully-funded), on top of more than approximately \$350,000,000 already spent, a total of \$2,050,000,000, to achieve a remedy that originally was estimated to cost approximately \$129,000,000 (NPV) or \$188,000,000 (fully-funded). In addition to several changes in the ultimate disposal method for these sediments and continually changing estimates

⁶⁸ ESD #1 at 6.

⁶⁹ *Id.* at 9.

⁷⁰ *Five-Year Review Report* at 10.

⁷¹ ESD #4 at 2.

⁷² Almost a *tripling* if compared with the 1990 FS estimated volume.



of the amount of sediment that needs to be remediated, EPA's cost estimate for actually conducting the work has increased substantially at every juncture:

<i>Document</i>	<i>Date</i>	<i>Estimated Cost</i>	
		<i>NPV</i>	<i>Fully-Funded</i>
Proposed Plan	Jan 1992	\$33,274,000	n/a
Proposed Plan Addendum	May 1992	\$42,925,950	n/a
Proposed Plan	Oct 1996	\$116,000,000	n/a
ROD 2	Sep 1998	\$129,000,000	\$188,000,000
ESD #1	Sep 2001	n/a	\$330,948,431
ESD #2	Aug 2002	n/a	\$318,822,076
Five-Year Review	Sep 2005	n/a	n/a
ESD #3	Mar 2010	n/a	n/a
ESD #4 (proposed) ⁷³	Jun 2010	\$362,000,000	\$1,200,000,000
		\$401,000,000	\$767,000,000
		\$393,000,000	\$422,000,000

From the estimate of approximately \$188,000,000 (fully-funded) presented in ROD 2,⁷⁴ the estimated costs to complete have increased to \$330,948,341 in ESD #1 (fully-funded) or \$318,822,076 (fully-funded) in ESD #2. Under the most optimistic of scenarios, EPA now estimates a cost of \$886,000,000 (~\$350,000,000 already spent plus \$536,000,000 to complete⁷⁵) assuming no ESD #4 and funding at \$80,000,000 per year (and a substantially greater cost, up to \$2,050,000,000, at funding of \$15,000,000 per year). Such an increase in cost alone, even without regard to the fundamental changes as to other legally relevant factors, must be regarded as a fundamental change to a remedy and subject to the more rigorous standards triggered by a ROD amendment.

⁷³ ESD #4 estimates costs both on a NPV and fully-funded basis, and does so with respect to three annual funding scenarios (\$15 million, \$30 million and \$80 million).

⁷⁴ The January 1992 Proposed Plan, May 1992 Proposed Plan Addendum, and October 1996 Proposed Plan provided NPV estimates for the OU1 remedy, respectively, of \$33,274,000, \$42,925,950 (\$9,651,950 plus the earlier estimate of \$33,274,000), and \$116,000,000. ROD 2 projected a cost of \$129,000,000 (NPV).

⁷⁵ See ESD #4 at 12.



C. Time.

The New Bedford Harbor cleanup, which was projected in 1998 to be completed in approximately eight years, now may take as long as 58 years (12 years since ROD 2 plus as much as 46 years). Though the below table illustrates the same upward movement for project duration as noted for volume and cost, EPA's presentation has made it difficult to understand the expected duration of the remedy, i.e., the time required to achieve remedial action objectives, for the 14-year period from the October 1996 Proposed Plan to ESD #4.

Document	Date	Project Duration				Comment
		Years		Completion Date		
Proposed Plan	Jan 1992	6		n/a		
Proposed Plan Addendum	May 1992	6.5		n/a		
Proposed Plan	Oct 1996	n/a		n/a		No information provided.
ROD 2	Sep 1998	8		n/a		See ROD 2, Table 9.
ESD #1	Sep 2001	n/a		2007		See ESD #2, Responsiveness Summary, at C-14.
ESD #2	Aug 2002	n/a		2011		See ESD #2, Responsiveness Summary, at C-14.
Five-Year Review	Sep 2005	n/a		n/a		
ESD #3	Mar 2010	n/a		n/a		
ESD #4 (proposed) ⁷⁶	Jun 2010	Alt. 1	Alt. 2	Alt. 1	Alt. 2	See ESD #4 at 12.
		58	52	2056	2050	
		52	38	2050	2046	
		19	18	2017	2016	

The January 1992 Proposed Plan and the May 1992 Proposed Plan Addendum clearly presented the expected project duration.⁷⁷ The October 1996 Proposed Plan, however, did not indicate project duration anywhere within its pages. Further, any estimation of time was well

⁷⁶ ESD #4 derives the amount of time required to complete each remedy alternative using three annual funding scenarios (\$15 million, \$30 million and \$80 million). AVX questions whether it is ever appropriate and consistent with the NCP for EPA to generate multiple time scenarios and – since cost is a function of time – cost estimates for a project in remedial action.

⁷⁷ 1992 Proposed Plan at 18; 1992 Proposed Plan Addendum at 13.



hidden in ROD 2, found only in the NPV calculation in Table 9, and for ESDs #1 and #2, emerged only in ESD #2's responsiveness summary.⁷⁸

Time, or more accurately, the project duration or length of time needed to achieve remedial action objectives, is a very important factor under the NCP, as recognized by EPA guidance. An evaluation of a remedy that does not have a time certain cannot possibly comply with the NCP. The *Cost Guidance* notes, in presenting the "detailed analysis of alternatives," that the NCP requires: "The types of costs that shall be assessed include the following: (1) Capital costs, including both direct and indirect costs; (2) Annual operation and maintenance costs; and (3) Net present value of capital and O&M costs." 40 CFR 300.430(e)(9)(iii)(G).⁷⁹ To perform a present value analysis, the *Cost Guidance* states that the first thing necessary is to define the period of analysis. "In general, the period of analysis should be the equivalent to the project duration."⁸⁰

Further, EPA cannot assess the short-term effectiveness of a remedy, as required by the NCP, without a definite understanding of project duration. The NCP requires that remedies be evaluated for short-term effectiveness during the remedy selection process.⁸¹ In order to evaluate the short-term effectiveness of a remedy, EPA must consider the period of time needed to achieve protection as well as any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.⁸² This is especially true of PCB-contaminated sites.⁸³

Like volume and cost, the exponential increases in time and project duration, as illustrated in the above table, must be regarded as a fundamental change to a remedy and subject to the more rigorous standards triggered by a ROD amendment.

⁷⁸ ROD 2, Table 9; ESD #2 at C-14.

⁷⁹ *Cost Guidance* at 2-5 to 2-6.

⁸⁰ *Cost Guidance* at 4-1 to 4-2.

⁸¹ 40 CFR 300.430(e)(9)(iii)(E).

⁸² *A Guide to Selecting Superfund Remedial Actions* (USEPA, 1990), 9355.0-0-27FS, at 3.

⁸³ *Guidance on Remedial Actions for Superfund Sites with PCB Contamination* (USEPA, 1990), EPA/540G-90/007, at 61-62.



IV. NO FURTHER WORK SHOULD BE DONE AT OU1 OF THE NEW BEDFORD HARBOR SUPERFUND SITE WITHOUT A ROD AMENDMENT.

A. EPA Should Have Started the ROD Amendment Process in 2004.

Since 1996, EPA has actively encouraged all regions to update remedies consistent with the NCP and EPA guidance to reflect current science and technology in order to improve cost effectiveness.⁸⁴ To implement such remedial updates, the NCP and EPA guidance provide clear instruction regarding how to proceed when EPA receives information that could affect the implementation, or require reassessment, of the selected remedy.⁸⁵ When this information is received, EPA is to evaluate its impact on the selected remedy by examining its effect on the scope, performance, and cost of the remedy.⁸⁶ Based on this evaluation, and “depending on the extent or scope of the modification being considered,” EPA is to determine whether the change would be significant or fundamental.⁸⁷ Where changes will be fundamental, “a repetition of the ROD process, including issuance of a revised [Proposed Plan]” is required, along with a new nine-criteria and ARAR analysis for the portion of the ROD that is being amended.⁸⁸ Additionally, where new information arises during the process of a five-year review that calls into question the protectiveness of the remedy, EPA guidance provides for undertaking site characterization, focused feasibility studies, treatability studies, and sampling, as well as other methods for gathering data regarding the protectiveness of the remedy.⁸⁹

By 2004, EPA was well aware of information that required reassessment of the remedy. EPA first acknowledged that it would run out of dedicated funds for the cleanup in ESD #2 in 2002. EPA also knew that the Superfund – created by a then-expired tax – would be exhausted shortly. By 2003 it was depleted. Ultimately, EPA Headquarters provided an annual allotment of \$15,000,000 per year for the New Bedford Harbor cleanup, supplemented by a

⁸⁴ Luftig, Stephen, Breen, Barry. 1996. *Superfund Reforms: Updating Remedy Decisions*. EPA540/F-96/026, available at <http://nepis.epa.gov/Exe/ZyNET.exe/91007EYZ.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1995+Thru+1999&File=D%3A%5CZYFILES%5CINDEX+DATA%5C95THRU99%5CTXT%5C00000025%5C91007EYZ.TXT&User=anonymous&Password=anonymous&ImageQuality=r85g16%2Fr85g16%2Fx150y150g16%2Fi500&Display=hpfrw&Back=ZyActionS&MaximumPages=5&Query=fname%3D%291007EYZ.TXT%22>.

⁸⁵ 40 CFR § 300.825(c); *A Guide To Preparing Superfund Proposed Plans, Records Of Decision, And Other Remedy Selection Decisions Documents* (USEPA, 1999), EPA 540-R-98-031 (hereinafter “*Superfund Guide*”), at 7-1.

⁸⁶ 40 CFR § 300.435(c)(2).

⁸⁷ *Superfund Guide* at 7-1.

⁸⁸ *The Road to ROD, Tips for Remedial Project Managers* (USEPA and USDOD, 1992). See also, 40 CFR § 300.435(c)(2); *Superfund Guide* at 7-5.

⁸⁹ *Comprehensive Five-Year Review Guidance* (USEPA, 2001), EPA 540-R-01-007, at 4-11 to 4-13.



one-time increase over the last two years due to stimulus funding. A dramatic increase in the volume of dredge spoils, coupled with the low funding levels, transformed the OU1 cleanup from an approximately \$130,000,000 remedy which would take 6 years to implement to a remedy that might cost over \$1,000,000,000 and take more than 50 years to reach remedial objectives.

Most significantly, EPA itself recognized by late 2004 that fundamental changes to ROD 2 were required, leading it to start an internal remedy review and alternatives analysis, with the express goal of a ROD amendment by 2008.⁹⁰ In the first *Five-Year Review Report*, EPA acknowledged that it would evaluate alternative cleanup methods to address the “long time frame of current remedial approach,” and analogized to its experimental efforts regarding the pilot underwater cap near Cornell-Dubilier Electronics, Inc.⁹¹ EPA’s comparison greatly understated both the problem it faced and the extent to which the remedy would have to change to deal with it. Having established an internal goal of a ROD amendment, EPA should have immediately begun an evaluation of remedial alternatives under the nine criteria in accordance with the NCP and guidance. This could have been cost-effectively accomplished through the use of a focused feasibility study or similar approach.

Instead, EPA embarked on an unstructured and frequently delayed approach that has spanned over five years as ROD 2 costs continued to escalate. The slow pace of EPA’s evaluation belies the amount of money that is at stake in this project. As demonstrated above, EPA and its remediation partner, the USACE, have known for many years that capping was a proven technology. There is frequent evidence of significant budget estimate increases and schedule delays throughout this *ad hoc* process between 2005 and 2010, with little, if any, documentation of why. In most cases, the only documentation is just an updated budget estimate spreadsheet. There is no evidence of any accountability for any budget estimates or, any other activities on the project, for that matter, nor is there any evidence of explicit goals for this evaluation, only a general theme that EPA needs to find “something else.”⁹²

⁹⁰ See EPA FOIA documents, *supra* note 36, Section II.A.3.

⁹¹ *Five-Year Review Report* at vii and 22.

⁹² There are echoes from the past in this description of EPA’s activities over the past 5-6 years. In May 30, 1995 correspondence submitted to EPA regarding the March 28, 1995 proposed ESD for OU2, AVX commented:

Action leading up to, and implementation of, the ESD remedy will entail substantial incremental costs. These costs are associated with the last two years of negotiation of this interim remedy, design changes to the CDF and treatment systems, development of operational and management (O&M) costs, as well as additional costs required to re-evaluate a final remedy for the sediments stored in the CDF. AVX believes these costs are due to work that is not only incremental to, but duplicative of, efforts that had already taken place during the process leading to the original ROD for Operable Unit [2]. In addition, the eventual cost for alternative remedies, when they are finally implemented, will have significantly escalated due to inflation. Despite EPA’s stated “belief” that the modified remedy is cost-effective, the draft ESD is completely silent as to the costs associated



EPA should have re-opened the FS very soon after realizing that the cleanup was foundering and initiated a formal process for finding a more timely and cost-effective solution by establishing explicit objectives, schedules with milestones, and budgets, just as EPA guidance requires. The result would have been a ROD amendment to implement a comprehensive solution for OU1, maybe even by 2008, within the time frame originally mentioned in the internal EPA documents. Failure to achieve remedial objectives sooner rather than later has many ongoing consequences, both to the environment and to the community's goals for use and enjoyment of the harbor and its waterfront.

Even now, EPA eschews this logical and necessary approach, putting off what seems like the inevitable abandonment of CDFs for another few years. This is emblematic of EPA's approach to the management of New Bedford Harbor's impacted sediments. Although EPA indicates use of CAD cells is environmentally protective and much more cost-effective than treatment and off-site disposal, it shies away from proceeding immediately with the common sense and comprehensive solution of disposing of all sediments in CAD cells. No good reason has been given why EPA has not delayed ESD #4 until it can come to grips with the viability of an Upper Harbor CAD cell.⁹³ Rather than letting sound science and engineering drive its decisions, EPA has side-stepped its responsibility and made decisions based upon factors unknown to the public.

B. As of 2010, the Cumulative Changes to the "Existing Official Remedy" Are So Fundamental that EPA Must Start the ROD Amendment Process Now.

The NCP establishes the foundation for distinguishing between a ROD amendment and an ESD. In pertinent part, 40 CFR § 300.435(c)(2) states:

After the adoption of the ROD, if the remedial action or enforcement action taken, or the settlement or consent decree entered into, differs significantly from the remedy selected in the ROD with respect to scope, performance, or cost, the lead agency shall consult with the support agency, as appropriate, and shall either: (i) Publish an explanation of significant differences when the differences in the remedial or enforcement action, settlement, or consent decree significantly change but do not fundamentally alter the remedy selected in the

with the change in remedy, so that neither the community or the PRPs have any idea of what is involved. This is a glaring deficiency that belies EPA's assertion of cost-effectiveness.

⁹³ A delay of 12-18 months pales in comparison to the time EPA has already lost. One can only speculate whether the schedule is driven by the New Bedford/Fairhaven Municipal Harbor Plan, and specifically EPA's desire to avail itself of the opportunity to use a navigational CAD cell to dispose of Superfund dredge spoils. The inconsistency of this course of action with fundamental environmental policy concerning minimizing, not increasing, hazardous waste, is the subject of comments in Section II.D. above.



ROD with respect to scope, performance, or cost. . . . or (ii) Propose an amendment to the ROD if the differences in the remedial or enforcement action, settlement, or consent decree fundamentally alter the basic features of the selected remedy with respect to scope, performance, or cost.

The regulation states that EPA must use an ESD when there is a “significant change” in the scope, performance or cost of a remedy, but a ROD amendment when the proposed change “fundamentally alters” the “basic features” of the remedy with respect to scope, performance or cost. For an ESD, no formal public comment period is required; EPA need only publish a notice containing a brief description in a local newspaper.⁹⁴ For a ROD amendment, however, the agency must develop and document the changes consistent with the process that led to the original ROD, including the creation of a proposed plan highlighting the changes and a formal public comment period.⁹⁵

In determining what types of alterations to a remedy rise to the level of “fundamental,” reference to guidance and practical usage is helpful. The *Superfund Guide*, the foremost source of information in this context, states that the categorization of a post-ROD change to a previously-selected remedy is a “site-specific determination” that must be made with reference to the three variables of scope, performance, and cost.⁹⁶ The specific questions for EPA to consider for each factor are laid out below, followed by the answers in the site-specific context of the New Bedford Harbor (including EPA’s pragmatic view that there will be no CDFs):

Scope: Does the change alter the scope of the remedy (e.g., type of treatment or containment technology, the physical area of the response, remediation goals to be achieved, type and volume of wastes to be addressed)?

- **New Bedford Harbor:** ESD #4 will accomplish the second change in containment technology for the sediments first intended for CDF D and then for off-site disposal. Once CDFs are completely abandoned, there will be a complete change in disposal technology. The volume of contaminated sediments requiring disposal has more than doubled since 1998. Query whether the remediation goals will be achieved in view of the potentially extended time to implement the remedy.

⁹⁴ EPA guidance, however, recommends that the lead agency provide supporting agencies an opportunity to comment on the ESD. *Guide to Addressing Pre-ROD and Post-ROD Changes* (USEPA, 1991), 9355.3-02FS-4, available at http://www.mmr.org/irp/plans/images/ROD_Protocols.pdf. EPA also sometimes seeks public comment before finalizing an ESD, as it has here. See *Ottati & Goss/Kingston Steel Drum*, ESD OU4 (February 2, 2002), available at <http://www.epa.gov/superfund/sites/rods/fulltext/e0102016.pdf>, and *Otis Air National Guard Base* OU5 (October 31, 2000), available at <http://www.epa.gov/superfund/sites/rods/fulltext/e0101017.pdf>, for two examples of the same practice in Region 1.

⁹⁵ See 40 CFR § 300.435(c)(2); see also *Superfund Guide* at 7-4 and 7-5.

⁹⁶ *Superfund Guide* at 7-1.



Performance: Would the change alter the performance (e.g., treatment levels to be attained, long-term reliability of the remedy)?

- **New Bedford Harbor:** While ROD 2 itself failed to make explicit consideration of the length of time for implementation of the remedy to achieve remedial goals, both the Proposed Plan and the Proposed Plan Addendum that preceded it estimated the project duration as 6 and 6.5 years, respectively. Now, the project duration (beginning in 1998) is estimated to be from 18 to 58 years, 3 to 9 times longer. Further, one major aspect of the methodology used to achieve cleanup goals has changed for a substantial portion of the sediments,⁹⁷ with the strong likelihood that the change will apply to all remaining sediments.

Cost: Are there significant changes in costs from estimates in the ROD, taking into account the recognized uncertainties associated with the hazardous waste engineering process selected? (Feasibility study cost estimates are expected to provide an accuracy of -30% to +50%.)⁹⁸

- **New Bedford Harbor:** The 1998 ROD estimated dredging and storage at CDFs would cost \$129,000,000 (NPV) or, in terms that EPA adopted in ESD #1, \$188,000,000 (fully-funded). By contrast, the remedy, once ESD #4 is finalized, is estimated to cost anywhere from \$362,000,000 to \$401,000,000 (NPV) or \$422,000,000 to \$1,200,000,000 (fully-funded), depending on annual funding levels. Thus, the costs have not just doubled in 12 years but, when taking into account the +50% cost range as well as the approximately \$350,000,000 already

⁹⁷ The *Updating Remedy Decisions at Select Superfund Sites: Biannual Report FY 1998 and FY 1999* ("1999 Summary Report"), and the *Updating Remedy Decisions at Select Superfund Sites: Biannual Report FY 2002 and FY 2003* ("2003 Summary Report") add "methodology used to achieve cleanup goals, and new technology not considered in the original ROD" as examples of performance-type questions. *1999 Summary Report*, EPA (USEPA, 2001) 540-R-01-00, available at <http://www.epa.gov/superfund/programs/reforms/docs/urd98-99.pdf>, at 4; *2003 Summary Report*, (USEPA, 2004), EPA 540-R-04-010, available at <http://www.epa.gov/superfund/programs/reforms/docs/urd02-03.pdf>, at 5. The *Updating Remedy Decisions at Select Superfund Sites: Biannual Report FY 2000 and FY 2000* ("2001 Summary Report") and *Updating Remedy Decisions at Select Superfund Sites: Biannual Report FY 2004 and FY 2005* ("2005 Summary Report") give a single example of a "change in disposal or discharge point." *2001 Summary Report*, (USEPA, 2003), EPA 540-R-03-001, available at http://www.epa.gov/superfund/programs/reforms/docs/rem_report.pdf, at 8; *2005 Summary Report*, (USEPA, 2007), EPA 540-R-06-074, available at <http://www.epa.gov/superfund/programs/reforms/docs/urd04-05.pdf>, at 7.

⁹⁸ In reference to cost, the *1999 Summary Report* and *2003 Summary Report* ask: "Does the update alter remedial costs and are the changes in costs of such a nature that they could not have been anticipated based on (1) the estimates in the ROD; and (2) the recognized uncertainties associated with the selected remedial alternative?" *1999 Summary Report* at 4; *2003 Summary Report* at 7. Regarding cost, the *2001 Summary Report* and *2005 Summary Report* simply state, "there is a more cost effective way to implement the remedy." *2001 Summary Report* at 8; *2005 Summary Report* at 7.



spent on the OU1 remedy, have increased at least five times and could be more than eleven times greater than originally estimated.⁹⁹

The *Superfund Guide* next provides a rough definition of significant and fundamental changes. EPA defines a “fundamental change” as one that involves “an appreciable change or changes in the scope, performance, and/or cost or may be a number of significant changes that together have the effect of a fundamental change.” Emphasizing the importance of viewing all changes as a whole, EPA further states that an “aggregate of nonsignificant or significant changes could result in a fundamental change overall.”¹⁰⁰

The regulatory history of the NCP provides additional guidance on what constitutes a “fundamental change” to a remedy. EPA accepted public comment on what revisions were desirable as part of the rule-making procedure that led to major revisions to the NCP in 1990. EPA noted, “Many commentators contended that the distinction between a significant difference and ROD Amendment was not clear and requested clarification.”¹⁰¹ EPA then stated that the appropriate threshold for amending a ROD is when a fundamentally different approach to managing hazardous wastes at a site is proposed.¹⁰² The agency went on to state that if “the action, decree, or settlement fundamentally alters the ROD in such a manner that the proposed action, with respect to scope, performance, or cost, *is no longer reflective of the selected remedy in the ROD*, the lead agency will propose an amendment to the ROD.”¹⁰³

The italicized text underscores the importance of comparing the revised remedy to the original remedy in order to properly frame the degree to which the original ROD is being altered and whether that alteration is fundamental or significant. Thus, it stands to reason that a remedy that was considered and expressly rejected in the original ROD, then at a later time

⁹⁹ The calculations are as follows: (1) 150% of estimated future cost (NPV and fully-funded); (2) plus approximately \$350 million of past costs for OU1; (3) divided by the ROD 2 estimated cost (NPV or fully-funded); (4) yields the multiplier. Specifically, as to NPV estimates: (\$15M/year: $362 + 181 + 350 = 893/129 = 6.9$); (\$30M/year: $401 + 201 + 350 = 952/129 = 7.4$); and (\$80M/year: $393 + 197 + 350 = 940/120 = 7.3$); and as to fully-funded estimates: (\$15M/year: $422 + 211 + 350 = 983/188 = 5.2$); (\$30M/year: $767 + 384 + 350 = 1,501/188 = 8.0$); and (\$80M/year: $1,200 + 600 + 350 = 2,150/188 = 11.4$).

¹⁰⁰ *Superfund Guide* at 7-1; see also *1999 Summary Report* at 4, and *2003 Summary Report* at 5.

¹⁰¹ Preamble to 1990 NCP, 55 Fed.Reg. 8666, 8772 (1990).

¹⁰² *Id.* at 8771.

¹⁰³ *Id.* (emphasis added). EPA provides the following example: “[T]he lead may agency may have selected an innovative technology as the waste management approach in the ROD. Studies conducted during remedial design may subsequently indicate that the innovative technology will not achieve the remediation goals specified as protective of human health and the environment in the ROD. The lead agency, based on this information, may determine that a more conventional technology, such as thermal destruction, should be used at the site. In this event, the lead agency will propose to amend the ROD.” *Id.* at 8772 (1990).



reconsidered and selected as the remedy, as ESD #4 proposes,¹⁰⁴ would appear less likely to be “reflective of the selected remedy in the ROD.” In a decision finding that EPA had made fundamental changes in scope and cost that altered the remedy, the Tenth Circuit, in *United States v. Burlington Northern Railroad Company*, 200 F.3d 679 (10th Cir. 1999), specifically noted that the change in handling from off-site disposal to incineration for over half of the sludge was a change in scope, noting that “both the initial plan and its amendment specifically rejected the idea of off-site incineration of the impoundment sludge.” *Id.* at 693-94.¹⁰⁵ Likewise, in New Bedford Harbor, use of CAD cells for disposal of some or all of the remaining sediments is a fundamental change in scope.

If ESD #4 is adopted, how will the current remedy compare to the remedy selected in ROD 2? ESDs #1 and #2 combined to make many changes to ROD 2 including: (1) an expansion of the intertidal clean-up area; (2) the mechanical de-watering of dredged sediments; (3) a change in the design of the CDF D contaminated sediment storage facility; (4) the use of an abandoned rail spur to move contaminated waste to an off-site disposal location; and (5) the eventual elimination of the CDF D contaminated sediment storage facility. ESD #3 and proposed ESD #4 make further changes to the remedy including: (1) temporarily storing PCB-contaminated sediments at the Pilot Study CDF; (2) waiver of an ARAR that normally requires a double liner design for hazardous waste storage facilities; (3) construction of a CAD for holding contaminated sediment originally intended for CDF D; (4) modification of ESD #2’s solution to send that same sediment off site for disposal when ESD #2 eliminated CDF D; and (5) proposed combination of sediment from remedial dredging with that from navigational dredging in the proposed CAD cell.

¹⁰⁴ In similar fashion, one of the changes introduced in ESD #1 was mechanical dewatering which was evaluated originally as potentially useful in the 1990 FS, but not selected in ROD 2 because “EPA believed that the remedy could be implemented without the added expense of the mechanical dewatering step.” ESD #1 at 6.

¹⁰⁵ In the Tenth Circuit case, EPA first selected a remedy of excavation and on-site incineration in the ROD. When costs rose, EPA issued an amended ROD that called for excavation of sludge to be pumped into rail cars to be treated off site. The temporary cell liner, estimated to take up 3 one-cubic-yard boxes, was to be sent off site and incinerated. Increased solids in the sludge led to numerous changes: (1) installation of a settling box to allow solids to settle from sludge before pumping; (2) hand removal and incineration of “tar heels” that settled in rail cars; (3) an increase in the number of cell liners from 20 boxes to 396 boxes and the incineration of these boxes along with the “muck” that unexpectedly adhered to the liners. EPA argued that these three changes were three separate insignificant variations on the remedy, but the District Court found that these changes all sprung from one changed condition, and that the remedy was fundamentally altered as to scope and cost (61% increase in cost). The Tenth Circuit Court of Appeals disagreed that the use of the settling tank was a fundamental change because the increased cost was minimal and it caused no delay. However, the incineration of 376 additional boxes of liners and tar heels resulted in “over half of the impoundment sludge being incinerated, despite the fact that incineration of the impoundment sludge had been specifically rejected,” which would be a fundamental change in scope. *Id.* at 694. The total costs increased 61% (\$1.4 million) over the ROD Amendment, a fundamental change in cost. Thus, the Court held that these changes fundamentally altered the remedy.



Further, EPA has never even mentioned in any decision document the changes in land use over the twelve years from ROD 2 to ESD #4. The first *Five-Year Review Report*, as well as EPA's October 2004 presentation at the Severson Conference, note the "well-documented trend towards changes in shoreline land use from commercial/industrial to public access and residential,"¹⁰⁶ which require coordination with the OU1 remedy, particularly over the long period it may take to implement the remedy. By now, it is also obvious that consistency with the New Bedford/Fairhaven Municipal Harbor Plan, adopted pursuant to Massachusetts tidelands law and regulations, has emerged as a driving factor in remedy implementation and remedy selection. The *Superfund Guide* would treat the land use changes as significant even if they were the only changes to ROD 2.¹⁰⁷ When the land use changes are considered in combination with the many other changes described above, the conclusion is inescapable that there has been a fundamental change in the remedy.

At every decision point along the way, EPA had deemed each of these changes to be significant, but not fundamental. But EPA is not allowed to consider each change in a vacuum, and the critical overarching question is whether, taken as an aggregate, these changes have the effect of a fundamental change. In order to determine whether the OU1 remedy as modified by four ESDs is still reflective of the remedy selected by ROD 2, the starting point for examination of the cumulative effect of all these changes is not the remedy after ESD #3, but the remedy adopted by EPA in 1998 in ROD 2.

Most of the technical changes from 1998 to the present have been summarized above. EPA has now chosen to utilize a containment technology that was previously presented to EPA in the 1990 FS and rejected, a factor specifically considered to be evidence of a fundamental change by the 10th Circuit. The remedy that emerges from ESD #3 and proposed ESD #4 is effectively a cancellation of ESD #2, suggesting that, at this point, EPA remedial thinking is going around in circles, with one ESD negating a previous one. But the three most fundamental changes that emerge from comparing the snapshots of the remedy in 1998 and 2010 are in the three areas discussed above in detail: volume, cost and time. And EPA has announced that it expects to issue a decision document abandoning the use of any of the CDFs in the next year or two. At that point, there will be nothing at all left of ROD 2's entire disposal strategy.

It is hard to imagine how anyone could characterize the totality of all of the changes described above as anything less than a fundamental change. Given these fundamental changes, AVX submits that there can be no question that the 2010 remedy EPA envisions for

¹⁰⁶ *Five-Year Review Report* at vii; see also *id.*, at 20-23; EPA's October 2004 presentation at the Severson Conference available at <http://www.epa.gov/region01/nbh/pdfs/presentations/213060.pdf>, slide 60. (Severson Environmental Services, Inc. is a private contractor performing the OU1 remedial action.)

¹⁰⁷ *Superfund Guide* at 7-1 and 7-3.



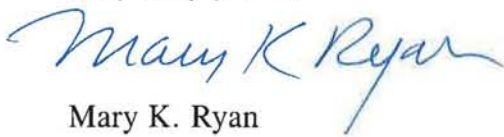
the New Bedford Harbor Superfund Site "is no longer reflective of the selected remedy in the ROD."¹⁰⁸

V. CONCLUSION.

From 2004 to 2010, EPA continued to spend time and money on all the steps necessary for off-site disposal of NBH dredge spoils, knowing that a more cost-effective remedy was likely available. EPA may be indifferent to this waste of time and money, but AVX is not, nor should the public be. Further expenditures of time and money in the absence of a thorough and comprehensive effort to evaluate and decide upon the best remedial approach to the cleanup of the Upper and Lower Harbors in light of the many fundamental changes and new information since 1998, much of it collected by the agency itself, cannot be justified. Accordingly, AVX submits that EPA should suspend consideration of ESD #4 and immediately commence further investigations and feasibility studies to support a ROD amendment for OU1.

Thank you for the opportunity to submit these comments.

Very truly yours,


Mary K. Ryan


Gary L. Gill-Austern

Attachments

cc (by e-mail only):

Elaine Stanley
Cynthia E. Catri, Esq.
Weldon S. Bosworth, Ph.D.

¹⁰⁸ Preamble to 1990 NCP, 55 Fed.Reg. at 8771.

ATTACHMENT 1

Copies of pages received in response to July 28,
2010 FOIA request cited in comment letter.



"Rigassio-Smith, Anita"
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01/19/2010 04:21 PM

To Dave Dickerson/R1/USEPA/US@EPA, Elaine T Stanley/R1/USEPA/US@EPA, "L'Heureux, Paul G NAE" <Paul.G.L'Heureux@usace.army.mil>, "Iorio, Maryellen" <Paul.G.L'Heureux@usace.army.mil>, "Fox, Steve (New Bedford)" <Steve.Fox@jacobs.com>, "Connor, Jackie" <Jackie.Connor@jacobs.com>, "Document Control - Bourne-New Bedford"

bcc

Subject Draft One CAD Cell Cost Estimates - \$15M, \$30M, \$80M

Please find attached cost estimates representing the one CAD cell approach (aka Hybrid) at three different annual funding levels. As with the 100% T&D cost estimates, it is assumed that all costs would escalate annually at 3.5%. For the \$15M funding scenario, it is assumed that the annual funding would increase annually also at 3.5%. For the \$30M and \$80M funding scenarios, it is assumed that the annual funding would not increase.

A quick summary of the two approaches at the three funding scenarios is shown here:

	100 % T & D			One CAD Cell		
Funding Scenario	Total Cost (\$)	PV (\$)	Lifetime (yrs)	Total Cost (\$)	PV (\$)	Lifetime ⁺ (yrs)
\$15M/yr	1.42B	386	42	983M	349M	2635
\$30M/yr	827M	413M	27	592M	355M	20
\$80M/yr	417M	374M*	6	369M	335M	5

*Value revised since Transmittal No. 0320-10 (1/13/10)

+ Lifetime does not incorporate cap monitoring

2 CAD CELL

\$320 PV

Feel free to call me or e-mail me with any questions.

Anita

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computer. Transmittal Draft One CAD Cell Cost Ests Jan2010.pdf Draft One CAD Cell 15M Jan2010.pdf



Draft One CAD Cell 30M Jan2010.pdf Draft One CAD Cell 80M Jan2010.pdf

L CADs @ \$80m

NEW BEDFORD HARBOR
ALTERNATIVE #4 2 CAD CELL SCENARIO

Funding Scenario - \$80 MIL/YR, 3.5% Escalation
-30%/-50% Accuracy

\$ 341,199,704 = TOTAL COST ✓
\$ 319,989,118 = NET PRESENT VALUE

\$320 NPW

6/09

YEAR #	1	2	3	4	5
ACTIVITY	UH Hydraulic Dredging, Nstar Crossing, LTM	ESD Signed, UH Hydraulic Dredging, Begin Build LHCC	TERC Recomplete, Finish Build LHCC, Install Silt Curtain, Demob C&D, Purchase Marine, Install LHCC Silt Curtain, Fill LHCC with LH MUs	UHCC organics, Remove Silt Curtain and Cap LHCC, Install UHCC Silt Curtain and Begin Fill UHCC with UH MUs, Begin Wetlands and Marsh Is. Resto.	Complete Fill UHCC with UH MUs, Complete Wetlands, Remove Silt Curtain and Cap UHCC, Empty Cell #1 & Cap DDA, LTM, Project Closeout
YEAR	2009	2010	2011	2012	2013
FUNDING	\$ 80,000,000	\$ 84,818,145	\$ 80,535,437	\$ 110,940,372	\$ 127,835,495

Equip.

Modflat (Pestor)

360
157
517
113
24
64
112
24
790

399
488.6
58.8
341.2

FIXED COSTS					
PLANNING & REPORTING	\$ 392,325	\$ 406,057	\$ 420,269	\$ 434,978	\$ 900,404
PROJECT MANAGEMENT	\$ 2,655,539	\$ 2,748,483	\$ 2,844,680	\$ 2,944,243	\$ 3,047,292
MOBILIZATION/DEMOLITION	\$ 3,482,662	\$ 3,583,855	\$ 3,709,290	\$ 3,839,115	\$ 3,973,484
OPERATIONAL SAMPLING & ANALYSIS	\$ 126,855	\$ 131,295	\$ 135,891	\$ 140,647	\$ 145,569
O & M	\$ 1,531,051	\$ 1,584,637	\$ 277,461	\$ 287,172	\$ 287,172
FEES	\$ 5,063,574	\$ 5,696,937	\$ 3,242,697	\$ 4,176,968	\$ 4,653,142
NAE EXPENDITURES	\$ 1,939,540	\$ 2,007,424	\$ 2,077,684	\$ 2,160,403	\$ 2,225,667
SEDIMENT SAMPLING & WQM	\$ 961,740	\$ 995,401	\$ 1,030,240	\$ 1,066,299	\$ 1,103,619
DATABASE O&M & WEB	\$ 296,250	\$ 306,618	\$ 317,350	\$ 328,457	\$ 339,953
SUBTOTAL	\$ 16,429,536	\$ 17,460,708	\$ 14,055,561	\$ 15,368,282	\$ 16,676,303
REMAINING FUNDING	\$ 63,570,464	\$ 67,357,437	\$ 66,479,876	\$ 95,572,090	\$ 111,159,192
REMAINING FUNDING AFTER 1ST ACTIVITY(IES) FOR SEASON	\$ 8,323,145	\$ 10,176,462	\$ 33,204,993	\$ 86,666,580	\$ 81,387,272
REMAINING FUNDING - or - (FUNDING NEEDED)	\$ 4,816,145	\$ 535,437	\$ 30,940,372	\$ 47,835,495	\$ 58,800,296
APPLICABLE UNIT RATE TSCA HYD DREDGING (W/CY)	307	318			
APPLICABLE UNIT RATE SILT CURTAIN (\$/DAY)			218,995	226,660	
APPLICABLE UNIT RATE MECHANICAL DREDGING - LH (\$/CY)			14		
APPLICABLE UNIT RATE MECHANICAL DREDGING - UH (\$/CY)				87	91
APPLICABLE UNIT RATE MECHANICAL NON-SUPERFUND (\$/CY)				87	
APPLICABLE UNIT RATE WETLAND EXCAVATION (\$/CY)				788	816
# OF DREDGING DAYS SUPERFUND MECHANICAL			112	113	113
# OF DREDGING DAYS SUPERFUND HYDRAULIC OR WETLANDS	204	204	0	80	80
# OF DAYS TO INSTALL SILT CURTAIN		0	30	30	0
# OF DREDGING DAYS MECHANICAL NON-SUPERFUND (UHCC organics?)				103	
VOLUME DREDGED NON-SUPERFUND (CY)				51,429	
VOLUME DREDGED SUPERFUND HYDRAULIC (CY)	180,000	180,000	0	0	0
CUMULATIVE VOLUME SUPERFUND (CY)	180,000	360,000	517,222	653,836	790,450
VOLUME DREDGED SUPERFUND MECHANICAL - UH (CY)				112,626	112,626
VOLUME DREDGED SUPERFUND MECHANICAL - LH (CY)			157,222	0	0
WETLANDS REMEDIATED (CY)				23,988	23,988
CUMULATIVE WETLANDS REMEDIATED (CY)				23,988	47,976
DATABASE ALTERNATIVE FIXED COSTS					
PURCHASE MARINE EQUIPMENT			\$ 4,620,100		
TERC RECOMPLETE			\$ 1,053,447		
INSTALL SILT CURTAINS			\$ 6,569,864	\$ 6,799,809	
REMOVE SILT CURTAIN & ADD CAP C&D				\$ 4,405,716	\$ 3,847,420
DEMOLITION			\$ 9,541,569		
STAR CROSSING	\$ 3,105,000				
MARSH ISLAND RESTORATION				\$ 3,266,137	
EMPTY CELL AND CAP DDA (AREA 0)					\$ 18,496,069
MODEL RESTORATION			\$ 11,489,904		
NARRAGANSETT LTM ROUNDS #5, #6	\$ 400,000				\$ 443,487
CONSTRUCT LHCC		\$ 9,641,025			

! abt check, seems low (prob OK, LH only)

15500

Cost Estimating for 2008-09 Off-Season
10/28/08
DRAFT

IF WSI GO W/ ROD Amendment (due to SLM. 10/28/08)

1. update cost of existing remedy (1a below)
2. update cost of 100% T&D (2006 est.)
3. est. hybrid remedy (T&D & LHCC)
4. cit. 2 CAD cell (Alt. 4)

1. 2009 ESD for Lower Harbor CAD cell (LHCC)

plan for Dec 2010 or 2011
depending on funding

a - develop cost and time to complete estimate for "existing official remedy" (3 CDFs and offsite T&D) at the \$15m, \$30m and \$80m funding levels (adjusted for inflation)

- assume the three CDFs are built and filled AFTER the T&D is completed

- assume dewatered filter cake is placed into the three CDFs (total air space volume = 211,000 cy; in situ disposal volume = 211,000 cy divided by 0.54/cake cy per in situ cy = 390,000 in situ cy: i.e., 852,000* cy - 390,000 cy = 462,000 in situ cy goes T&D)

*total vol is 862,000 cy - assumed 10,000 cy of dredging AVOIDED by ou3 cap

b - develop cost and time to complete estimate for "proposed LHCC remedy" (3 CDFs, interim T&D, and lower harbor CAD cell) at the \$15m, \$30m and \$80m levels

- assume 300,000 cy LHCC is excavated in 2011, and filled in 2012 and 2013 (and 2014 if needed??)

- assume interim T&D in 2009, 2010 and as needed after the LHCC is filled and prior to the three CDFs being built and filled (interim T&D volume = 852,000 total cy - 300,000 LHCC cy - 390,000 CDF cy = 162,000 cy).

2. 2010 ROD Amendment

Three disposal alternatives (develop cost and time to complete estimates at \$15m, \$30m and \$80m):

A - "b" from above (3 CDFs, interim T&D, lower harbor CAD cell)

B - 100% T&D (note: use the 2006 version of this (10/20/06 email from Bill Pencola) with updates to account for the two years of T&D that have taken place)

C - 2 CAD cells (one upper, one lower harbor) and interim T&D (i.e., Alternative 4)

D - 1 CAD & T&D ?? (hybrid) → will already have

CDF D Vol (air space) = 435,300 (Gibson, 1996)

÷ 0.54

806,070 cy in situ to CDFD

(11 ÷ 0.75 = 580k cy)

290k CDFs
162k T&D
300k LHCC
852

290k CDFs
162k T&D
300k LHCC
852



Dave
Dickerson/R1/USEPA/US
10/28/2008 12:20 PM

To K.C.Mitkevicius@nae02.usace.army.mil,
maurice.beaudoin@usace.army.mil,
Robert.A.Leitch@usace.army.mil,
cc Cynthia Catri/R1/USEPA/US@EPA, David
Peterson/R1/USEPA/US@EPA, ManChak
Ng/R1/USEPA/US@EPA, Doug Gutro/R1/USEPA/US@EPA,
bcc

Subject cost estimating for off-season

All - see attached direction for off season cost estimating to support the proposed 2009 lower harbor CAD cell ESD and 2010 ROD amendment. Note that some of this work has already been done, but may need some updating (e.g., cost and time to complete for 100% T&D).

Also, please let me know if you see anything amiss with the volume balance calcs.

In addition to this cost estimating, EPA will also need cost estimating support for cell #1 and pilot CDF related work. More to follow on these items shortly.

Thanks - Dave



cost.est.09esd.10roda.doc

2008/2009 Offseason Activities

Task	Subtask	Submittal Date	Reference Document	Assumptions
ESD for Lower Harbor CAD Cell (LHCC)	Complete "existing official remedy" and Compare with proposed LHCC Remedy	TBD	Dave Dickerson 10/28/08 e-mail and Task 3 - Technical Assistance (RFP #19 - TO7)	Cost Estimates for \$15m, \$30m, and \$80m/year levels
	A. Develop cost and time estimate for completion of "existing official remedy" (3 CDFs and Offsite T&D)	8/31/09		
	B. Develop cost and time estimate for completion of "Proposed LHCC Remedy" (3 CDFs, interim T&D, and Lower Harbor CAD Cell			
2010 ROD Amendment	Three disposal alternatives at \$15m, \$30m, and \$80m	April 24, 2009	Dave Dickerson 10/28/08 e-mail (detailed) and Task 4 - EPA Feasibility Study Input (RFP #19 - TO7)	
	A. Combination of offsite and onsite disposal within three (3) proposed CDFs	3/31/10		
	B. 100 percent offsite disposal of the TSCA material (current remedy)			
	C. Alternative 4, CAD cell approach that Jacobs is currently working on			

Alt. #3 (revised) NBH Alternatives Analysis - Jan. 2007
Use city CAD cells for disposal of less contaminated DMUs #22-37
and for capping after dredging in the upper harbor

Assumptions:

- next city CAD cell starts in June 2009 ("phase 4")
- ROD Amendment or ESD in place by June 2009
- phase 5 city CAD cell in 2012

Step 1. 2007-08: continue full scale dredging and offsite T&D (north to south).

Step 2. 2009: cost-share the city's phase 4 CAD cell to create 150,000 cy of disposal space for lower harbor Superfund material; place app. 118,000 cy of clean material from this phase 4 CAD cell as a 2 ft cap over areas dredged to date (i.e., MUs 1, 2, 3, 4 & 102(MF) (clean CAD material is free).

Step 3. winter 2009-10: mech. dredge all lower harbor DMUs (~150,000 cy) and place in phase 4 CAD cell.

Step 4. 2010-12: move back to full scale dredging and offsite T&D for MU5 thru MU8 (66,000 cy).

Step 5. 2013: cost share phase 5 city CAD cell; place 61,000 cy of clean material from it as 2' cap at MU5 - 8.

Step 6. 2014 (>1 yr?): mech. dredge MU22-MU32 (~163,000 cy) and place in phase 5 city CAD cell.

Step 7. 2015-24: move back to full scale dredging and offsite T&D for MU9 thru MU21 (246,000 cy).

Step 8: all vegetated MUs (50,000 cy) offsite T&D (no Area D needed). Note: the high PCB VU-1 could (and should) be excavated and restored sooner, to minimize recontamination of capped areas.

**New Bedford Harbor Superfund Site
Internal Remedy Review & Alternatives Analysis
Planning Meeting – 2/16/06
Meeting Minutes**

Minutes Prepared by: Gary Morin

Meeting Attendees:

Corps, New England – Gary Morin, Mark Anderson, Paul L'Heureux, Maurice Beaudoin

EPA – Dave Dickerson, Jim Brown

Jacobs Engineering – Mike Anderson, Ken Gaynor, Anita Rigassio-Smith

ENSR – Steve Wolf

Meeting Notes:

1. The meeting purpose, objective and agenda were first discussed as outlined in the Meeting Agenda, which is attached (Attachment 1). There was no discourse amongst the attendees regarding the meeting objective.
2. The objective of the Remedy Review process was discussed and Dave Dickerson indicated that the end goal is an amendment to the New Bedford Harbor Superfund Site Operable Unit #1 Record of Decision (ROD) assuming the review indicates that another remedy is more cost effective than the existing. The schedule is to complete the ROD amendment in early calendar year 2008 such that implementation of the new/revised remedy begins in the 2008 construction season. In addition, the Feasibility Study (FS) will also need to be revised prior to the ROD amendment. This means the revised FS needs to be complete in the fall of calendar year 2007.
3. EPA indicated that they would develop the revised FS and amended ROD and the Corps team would provide them with support and assistance. The major support/assistance activities that the Corps team is to complete are outlined in a document prepared by EPA, which is attached (Attachment 2). There are three tasks labeled appropriately as Tasks 1 through 3. The three tasks were discussed in detail and notes for each follow.
4. Task 1: Update the unit costs and schedule for current approach (transportation & offsite disposal) – The unit costs for the existing remedy will be developed based on actual costs from the '04 and '05 dredging/remediation seasons. The unit cost is to be all-inclusive (Corps, all contractors, misc., etc.) and a detailed breakdown of the how the cost was derived will also be presented. The unit cost will be used to calculate the cost to complete the project. The cost to complete will be calculated for three different yearly funding levels of \$15M, \$30M, and \$80M. Inflation is to be taken into consideration when calculating the cost to complete the project. The report entitled "Volumes, Areas and Properties of Sediment by Management Units", prepared by Foster Wheeler Environmental Corporation, will serve as the basis for the volume of sediment to be used in the calculations for the cost to complete. Jacobs Engineering will take the lead in

Conceptual CAD Remedy - NBH 12/17/04 13
DND

1. Dredge 2' of sediment from all areas N of PMC

- Vol = 334,228 cy (MU 1 → MU 18, MU 102 & 103)

- area = 4,512,084 ft² from Tbl 2 DNU report

- This material goes T & D at say 400 \$/cy =

say \$135 m (9 years at \$15 m/yr) (\$150 m @ 450 \$/cy
10 yrs)

2. Dredge 4' of sediment from within 45' deep CAD w/ 3:1 slopes
(400' x 400' base)

Vol = 670' x 670' x 4' = 66,000 cy

- assume ~~all~~ 1/2 TSCA, 1/2 non-TSCA

- 33,000 cy x 400 \$/cy = \$13.2 m

- 33,000 cy x 300 \$/cy = \$10 m

} \$23.2 m

- assume all material below 4' suitable for ^{disposal} in water

3. Dredge the clean CAD material and use as underwater cap
(for areas dredged in Step 1)

- 421,000 cy clean fill total (see p. 3)

- 334,000 cy back to upper harbor dredged areas

∴ 87,000 cy to Cape Cod Bay disposal, or
for cap of Cornell-Dob area? (MU-37)

- 3' cap at MU-37 = 89,111 cy!

- but, use City clean CAD material to cap MU-37 earlier?

GP

3
DDD
12-17-04

- need costs for Step 3:

334,000 cy
87,000 cy

3a - if \$200/cy = \$67m
- dredge clean CAD material and place in upper hbr.

3b - open water disposal of excess clean material
if \$300/cy = \$26m

$\Sigma = \$93m$

4. Dredge all remaining areas (including VU's) and dispose in CAD (except for MU 37 and MU 104 PMC)

- total vol. = 393,000* cy (Tab. 2)

- CAD Vol (not counting 4' cap) = 421,000 cy (see p.3)

\therefore 7 % excess volume in Theory*

* conservative, as 33,000 cy TSCA material removed in Step 2

- assume dredging & CAD disposal at say \$200/cy

- est. cost = \$78.6m say \$80m (n 5 years)

5. Place 4' clean cap on CAD

$$vol = 670' \cdot 670' \cdot 4' = 66,000 \text{ cy}$$

Options

- if \$200/cy = \$13.2m
- 1 - City pays (clean City CAD material)
 - 2 - S. fund pays (borrows pit in lower harbor)
 - ~~3 - stockpile~~

➤ likely to get this placed at no charge given the demand

12-17-04

3/3

DDD

6. Est. Total Costs & Timeframe

Step				Yrs
1.	\$135 - \$150 m			9-10
2.	say \$25 m			1
3.	\$93 m ??	say \$100?		3-6
4.	\$80 m			into 5 m/a
5.	13 m			
	\$340 - \$355 m			18-27
	\$346 - 361 m			13-17 years

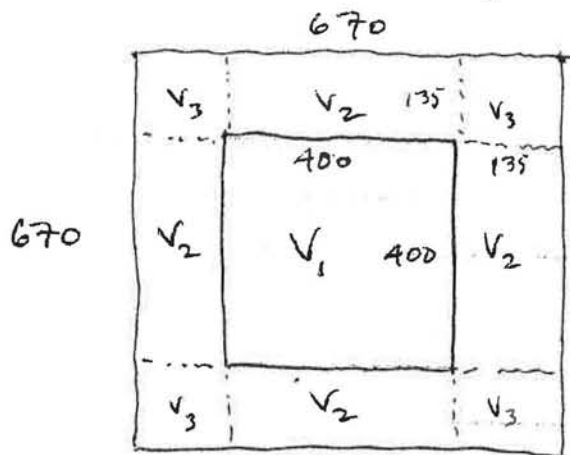
(not counting final cap)

Step 5
by others ???

What if Step 3 only \$100/cy? \Rightarrow \$42 m

total would then be ~~a \$300 m~~
\$295 - \$310 m (~~\$285 - 300 m~~)

Vol. of 45' deep CAD (400' · 400' base, 3:1 slopes)



$$V_1 = 400' \cdot 400' \cdot 45' = 267,000 \text{ cy}$$

$$V_2 = \frac{1}{2} (1600' \cdot 135' \cdot 45') = 180,000 \text{ cy}$$

$$V_3 = \frac{1}{3} (270' \cdot 270' \cdot 45') = 40,000 \text{ cy}$$

corners form a 4 sided pyramid

$$V_T = 487,000 \text{ cy}$$

$$V_{4' \text{ cap}} = 670' \cdot 670' \cdot 4' = 66,000 \text{ cy}$$

$$V_{\text{net}} = \underline{\underline{421,000 \text{ cy}}}$$

if 55'
 $V_1 =$

4.2 cm = 50'

1 cm = 119'

670 = 5,6 cm

131 = 1.1 cm

400 x 3.5 cm

814500

815000

815500

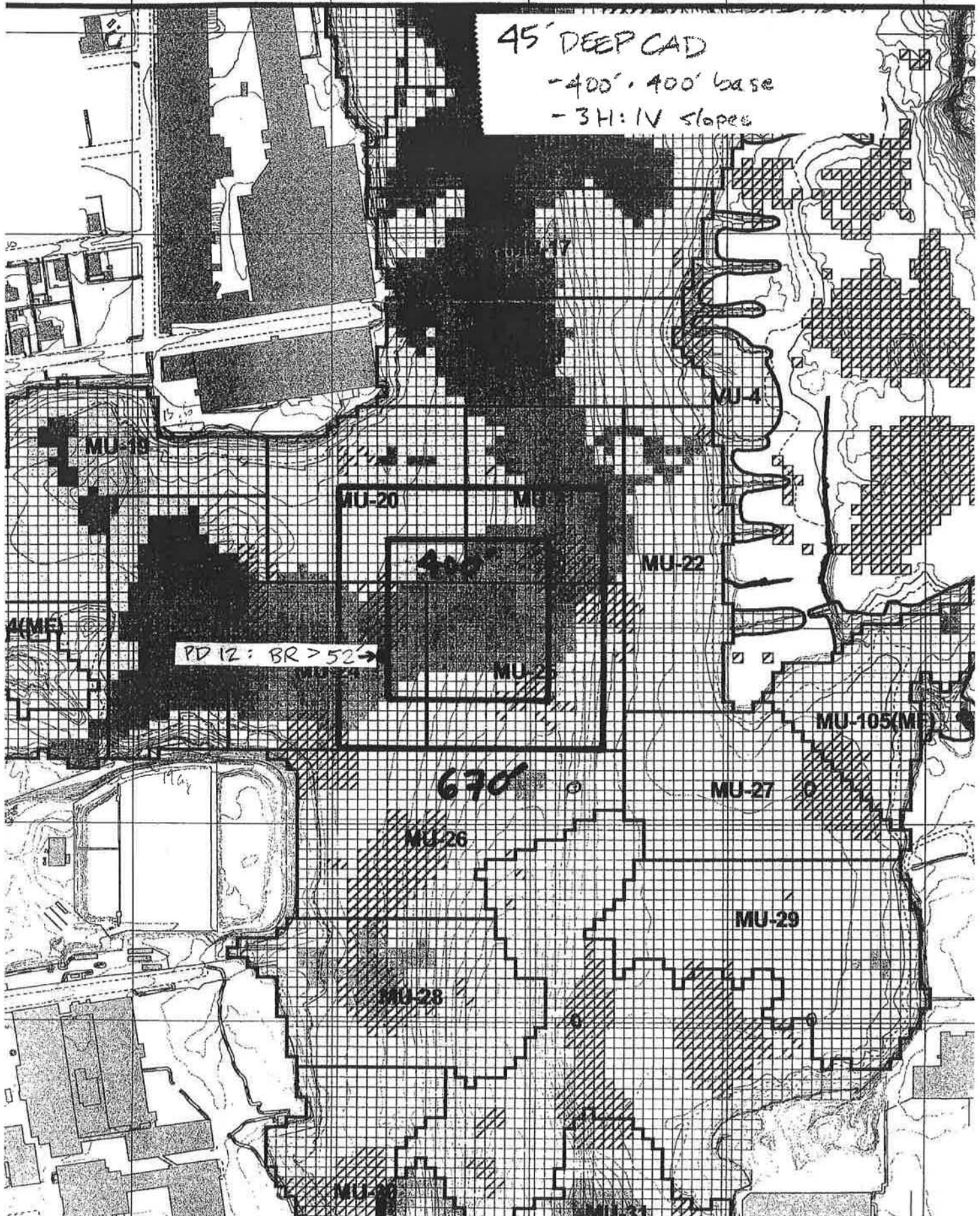
816000

816500

45' DEEP CAD

- 400' x 400' base

- 3H:1V slopes



ATTACHMENT 2

Comments of Dr. Robert Engler



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Fax (601) 629-6416

**Review of the June 2010 Draft Fourth Explanation of Significant
Differences for Use of a Lower Harbor CAD Cell
New Bedford Harbor Superfund Site, Operable Unit #1, New Bedford, MA**

September 3, 2010

ROBERT M. ENGLER, Ph.D., M.ASCE

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Summary:

I have reviewed the technical rationale for the proposed use of a Confined Aquatic Disposal (CAD) cell at the New Bedford Harbor Superfund Site applying well known and documented capping technology.

It should be clearly understood at the outset that a CAD site is a subset of the process of capping contaminated sediments with clean sediment to physically and chemically isolate contaminated sediments for the protection of human health and the aquatic environment. The CAD site could be a constructed pit or a natural depression. Significantly, the utility of a CAD cell rests with the site location and the proper engineering and design of the cap, with capping being the most significant containing feature. For that reason, the relevant technical literature concerns capping experience as much as CAD cell experience.

I find ESD #4's approach for chemical and physical isolation of contaminated sediments in the Lower Harbor CAD Cell (LHCC) to be technically sound, pragmatic and cost effective. Research and field application of capping of contaminated sediment on level bottom or in sub-aquatic constructed pits (CAD cells) dates back to the early and mid-1980s; its use was supported by extensive laboratory testing and field implementation. Capping has been used successfully at over 100 locations worldwide and 80 or more in the U.S. with CAD application at about 20 locations (Sed. Web, 2006, see attachment 1). I am further encouraged with the use of the extensive Clean Water Act regulatory framework as the legal vehicle to carry this out. The CWA implementation of the identification, assessment and management of contaminated sediment since 1975 (first sediment guidelines) has resulted in a vast technology base that set the foundation for Superfund remediation of contaminated sediments (<http://el.erdc.usace.army.mil/dots>). I am convinced that this contaminated sediment management alternative will provide sufficient protection to all components of the aquatic environment and protection of human health.

Professional Qualifications:

I have been technically responsible for the identification, assessment and management of contaminated sediments in navigation dredging and contaminated sediment remediation situations for the past 37 years. The purpose of my comments is to provide technical support showing the widespread use of capping in relation to CAD cells and their suitability for disposal, containment and management of contaminated sediments as set forth in the ESD #4 for the New Bedford Harbor Superfund site which proposes the use of dredging and CAD and capping technologies for site remediation. I have also provided additional technical documentation and input from personal experience.

By training and experience, I am a geochemist and throughout my career have specialized in the research and management of contaminated sediments. After serving in the U.S. Navy and completing my academic studies at Louisiana State University, I was employed from 1973 to 2005 by the USACE Waterways Experiment Station (WES), where I served in numerous positions: researcher, Program Manager, upper-management supervisor, Senior Scientist (Environmental) and technical lead of several national R&D programs dealing with dredging contaminated sediments supporting the USACE Navigation Mission and support to EPA. While

at WES, I made notable technical contributions that have advanced the state-of-the-art in the geochemistry of dredged material, flooded soils, wetlands, contaminated sediments, toxic substances, and aquatic disposal, as well as contributed to U.S. and international regulatory criteria and technical guidance documents. I have over 100 related publications. I also represented the Corps on numerous Congressional hearings, National Academy teams, litigation teams, international treaties and interagency regulatory negotiations. I have received numerous awards including the WES Gallery of Distinguished Employees. I joined Moffatt & Nichol in January 2006 and have worked on numerous environmental, regulatory dredging and contaminated sediments remediation and Superfund-related projects and have provided support to EPA on several of these projects. The projects ranged from harbor deepening to Superfund sediment cleanup activities. I have also served as an expert witness in Superfund and navigation dredging litigation. I represent clients both from the private sector and governmental areas. I also received the ASCE John G. Moffatt-Frank E. Nichol Harbor & Coastal Engineering Award.

Technical Background:

Capping of contaminated sediments is the engineered placement of a stable subaqueous covering of clean material over contaminated sediments on a level bottom, in depressions or in constructed subaqueous pits (i.e., confined aquatic disposal [CAD] cell). The cap is generally constructed of granular material such as suitable/clean sand, silts, clays or gravel or mixtures thereof. More complex caps may include geomembranes, layers of treatment materials (e.g., carbon) or liners as deemed necessary. The purpose of the cap is to:

- 1) separate contaminated sediment from organisms, include burrowing organisms¹ living at the sediment – water interface,
- 2) isolate the chemical contaminants from surface sediments and the overlying water, and
- 3) provide protection from breaching as a result of cap erosion.

As such, the thickness of the cap is driven by the following three elements: contaminant isolation, depth of bioturbation, and surface stability. The concentration and mobility of the chemicals of concern are important to the designed thickness of a cap where even the most heavily contaminated sites can be adequately contained. Cap thickness and upper layer armoring

¹ The activities of infaunal and epifaunal benthic organisms that collectively disturb the near surface sediment is termed bioturbation.

with gravel or stone can withstand major storms, waves or strong currents. The upper layer of a cap can also be physically designed to support the desired aquatic or wetland habitat as well as elevation at a given location. Both shallow, intermediate and deeper aquatic habitats can be restored. All of these concerns are addressed in the referenced design manuals. Furthermore, the National Research Council (NRC 2001, pp 210-215); discussed and supported the use of capping with clean sediments, with proper design and implementation, as a widely used and highly effective means of ensuring isolation of contaminated sediments.

Capping of contaminated dredged material in aquatic sites began in the 1970s, and capping for remediation and dredged material disposal to date has been conducted at over 100 projects world-wide and over 80 projects in the U.S. (Sed. Web 2006, see attachment 1). Of these projects, approximately 20 were used for CAD cells. As of 2006, the last time these data were compiled, *in-situ* capping, including capping of a CAD cell, has been selected as a component of the remedy for contaminated sediment at approximately fifteen Superfund sites (USEPA 2005). At some sites, *in-situ* capping has served as the primary approach for contaminated sediment management, and at other sites it has been combined with sediment removal (i.e., dredging or excavation) and/or monitored natural recovery (MNR) of other sediment areas (USEPA 2005, 2007).

A cap is designed to reduce risk resulting from sediment contamination through the following primary functions (USACE 1998; USEPA 1996, 2005):

- Physical isolation of the contaminated sediment sufficient to reduce exposure due to direct contact and to reduce the ability of burrowing organisms to move contaminants to the surface;
- Stabilization of contaminated sediment and erosion protection of sediment and cap, sufficient to reduce resuspension and transport to other sites; and
- Chemical isolation of contaminated sediment sufficient to reduce exposure from dissolved and colloiddally bound contaminants transported into the water column.

Caps may be designed with different layers to serve these primary functions or in some cases a single layer may serve multiple functions.

Advantages of caps and CAD cells include:

- Quickly reduce exposure to contaminants.
- Requires minimal infrastructure to construct.

- Reduce exposure of fish and other biota as compared to dredging or excavation.
- Final bottom elevation and design can create more desirable habitat or enhance habitat.
- Mitigate the risks associated with contaminant resuspension.
- Constructed with conventional equipment and locally available materials.
- Less expensive than full excavation transport and treatment/disposal of removed materials.
- Less disruptive to local communities than dredging or excavation.
- CAD limits lateral dispersion and mobility of disposed sediments.

Potential limitations of capping include:

- Contaminated sediments remain in the aquatic environment.
- Exposure of contaminants if cap is sufficiently disturbed or poorly designed.
- If water is shallow, institutional controls may be necessary for cap protection.
- Vertical groundwater gradients, if any, must be managed or the effectiveness of a cap may be jeopardized.

In order to properly site and design *in situ* subaqueous caps and a CAD cell and achieve project goals and mitigate limitations, the below project design and implementation framework is necessary. Rigorous application and documentation of this framework has been documented to provide a sound basis for successful contaminated sediment remediation whether capping is used as the sole remediation or when used in conjunction with partial excavation and removal of contaminated sediments.

- 1) Evaluate site conditions
 - a. Physical environment sediment characteristics
 - b. Waterway uses and infrastructure
 - c. Habitat alterations
- 2) Functional components of a cap
 - a. Physical isolation component
 - b. Stabilization/erosion protection component
 - c. Chemical isolation component
- 3) Capping considerations
 - a. Identification of capping materials
 - b. Geotechnical considerations

- c. Placement methods
- d. Performance monitoring

Capping/CAD Research and Field Experience:

Capping research was initiated by the USACE in the late 1970s and early 1980s within R&D programs under my technical responsibility. The first elements of this research were to determine cap texture and thickness to isolate the most soluble chemicals of concern and to inhibit bioturbation. Hydrodynamic and sediment transport modeling was used to establish cap physical stability under various wave and current climates. Field applications followed shortly, and by the end of the 1980s capping was considered a technically sound technology.

The CAD alternative goes further than level bottom capping since lateral movement of the contaminated sediments is contained by the pit (CAD) walls requiring a smaller environmental footprint. In 1989, a CAD approach was proposed for the New Bedford Superfund Project (USACE 1989) with design and monitoring guidance. Unfortunately, the CAD approach was not selected at that time even though dredging, transport and placement of contaminated sediments were well described and applied technologies. The issues noted in Sed. Web with regard to the pilot CAD cell in New Bedford Harbor, such as resuspension as related to the selection of dredge type, transport and placement, were operational issues that could readily have been addressed. Over the ensuing 20+ years, the same CAD approach proposed in 1989 for New Bedford Harbor sediments has proven successful at other sites. The capping and CAD technology is basically unchanged from the 1980s to present time and could easily have been applied in New Bedford Harbor at that time with as much success as is experienced today.

Capping of sediments has been successful at several sites grossly contaminated by wood treatment wastes which have NAPL (non-aqueous phase liquids-chemical fluids) in the sediment in combination with PAHs, creosote, and PCB, or other contaminants. Such sites technically are far more complex than the New Bedford Harbor contaminants.

Capping has been successfully applied individually or in combination with other cleanup technology at several locations and is planned for several more within North America. Capping contaminated sediments or capping combined with dredging for removal as a remediation technology has been conducted at over one hundred sites worldwide and over eighty

contaminated sites in the U.S. Several sites have used capping with or without dredging as well as capping of a CAD cell. Most of these sites were subsequently restored for wetlands (intertidal, aquatic or emergent) habitat. Several of these legacy sites were over one hundred years old (Sed. Web. 2006, see attachment 1). The examples were chosen to demonstrate the use of capping (used either as a level bottom cap or with a CAD cell) large and small surface areas, shallow, intermediate or deeper aquatic locations, high and low energy environments and restoration of desired habitat through sediment elevation management. These all have some relevance to the New Bedford Harbor area. Discussion of six of these complex sites where capping and/or CAD technology have been implemented successfully follows.

1) The Eagle Harbor Superfund Site (Wyckoff Site, since the early 1900s), Puget Sound, Bainbridge Island, WA

This site is a good example of the remediation and restoration success of capping without dredging. The sediments were severely contaminated with wood treatment chemicals and shipyard operations. In 1993, EPA installed a 50-acre clean 3-foot sediment (sand) cap followed by an extension of the cap to remediate large areas of the shoreline with the establishment of intertidal habitat. The cap was gently placed by washing it off a flat barge. The Eagle Harbor site continues to be assessed 15 years after initial capping. No chemical migration through the cap has been detected. NOAA has documented rapid and substantial development of high quality of benthic habitat. A more recently constructed thin layer cap (0.5 ft) over a 6-acre site was demonstrated, and clean up criteria are being met. This project has been deemed a success by multiple agencies. Because of the success of this project, the cap only technology will be used at four additional wood treatment sites in the region (Thea Foss; McCormick & Baxter-Stockton, CA; Pacific Sound Resources; McCormick & Baxter, Portland, OR).

2) St. Lawrence River at Massena, NY

An armored cap (1995) was used at the General Motors PCB Superfund site nearshore in the St. Lawrence River at Massena, NY. Sand, gravel, and armor stone were used due to high river velocities. In 1999, the armored cap appeared intact with no routine maintenance required. After the first year only minor repairs were necessary. It should be noted that sediment armoring and bank protection is a routine practice in nearshore areas and will work equally as well at remediation/restoration sites.

3) Lake Ontario, Ontario, Canada

This example is characterized by severe PAH contamination site where the source is coal degassification rather than wood treatment wastes. The location is in Lake Ontario, Ontario, Canada. The site also has free product (NAPL²) in the sediment within the contaminated sediment. The project was a 2.5-acre demonstration project that was successful; there was a significant reduction in the flux of site contaminants after capping.

4) Simpson Tacoma Kraft Superfund Site, Tacoma, WA

Another complex site where sediments were impacted with creosote, PAHs and dioxin contamination that was remediated by capping is the Simpson Tacoma Kraft Superfund site in Tacoma, WA. The nearshore contaminated area of about 17 acres was shallow (11-21 ft deep). The site was capped in 1988 and open water and nearshore habitat was restored. After more than 10 years of monitoring, all engineering, chemical, and habitat restoration goals continue to be met. The contaminants remain confined and isolated beneath the cap. The site also was given an environmental award for habitat creation. There was no dredging for removal of contaminated sediments.

5) Stryker Bay, Duluth, Minnesota

A non-wood waste site, Stryker Bay, located in Duluth, Minnesota, is a shallow flat-bottomed bay with an average water depth of 3 to 5 feet. From the 1890s to 1960, industrial activities on adjacent land to the north and east manufactured and refined coal tar and produced manufactured gas. PAH contaminants were discharged into the bay and contaminated the sediments. In 1983, the bay was added to the Federal Superfund list as part of the St. Louis River/Interlake/Duluth Tar (SLRIDT) site. The selected remedy in the Record of Decision (2004) was a dredge/cap hybrid design that consisted of a combination of environmental dredging, *in-situ* capping and dredged sediment containment. Dredging of approximately 224,000 cubic yards of contaminated sediment was conducted. Designers utilized many approaches in developing the design of this cap, including laboratory testing, modeling and reactive/adsorptive products. Consequently, combinations of remedial techniques and materials were employed. At Stryker Bay, a hybrid dredge/cap design included a combination that includes an activated carbon mat cap. Sand was placed by the contractor both mechanically and hydraulically. Both barge and land based

² Non-aqueous phase liquid.

deployment methods were used to install the activated carbon mat. A 15-acre CAD cell was constructed to contain the dredged sediment. After dredging, cover material was placed on the dredged area to isolate residual contamination and provide an adequate habitat for benthic recolonization.

6) Bayou Bonfouca Superfund Site, Slidell, LA

This was a large site (1991) for remediation of sediments that had been impacted by wood treatment products containing creosote since 1892. The approach used here initially included dredging with no capping. The sediments were contaminated with NAPL as well as thousands of parts per million of sediment-sorbed PAHs. The remedy included dredging to a prescribed elevation and removal of 170,000 cubic yards of contaminated sediments, treatment of 17,600,000 gallons of contaminated ground water and removal of 44,500 gallons of creosote oil. A sand cap was eventually placed at this site to contain and isolate the remaining residual contamination. A mile and a half of the Bayou was restored for aquatic life, as well as recreational and residential use (USEPA Region VI) over the exposed sediment. This site was one of the earliest large sediment remediation sites under Superfund and was deemed fully successful by EPA Region VI.

Conclusion:

Based on the factors discussed above, I believe that a CAD cell with appropriate capping design can be implemented in physically and chemically complex estuarine and harbor locations such as the upper and lower New Bedford Harbor. Capping contaminated sediments with use of a constructed CAD site is a proven technology where preferred sediment elevations can be maintained and diverse ecological amenities can be established. The technological description of the LHCC in ESD #4 is relatively comprehensive and complete and consistent with the state-of-the-practice. The regulatory components described in ESD #4 will ensure appropriate levels of protection to the environment and human health as well as the public interest. Isolating sediments contaminated with PCBs, other organics and metals in a CAD cell has the advantage of maintaining the sediments in a physically saturated and anaerobic environment. This represents a geochemically and physically stable condition and with an ecologically suitable sediment surface would be an environmental attribute. It is unfortunate that this approach was

not selected two decades ago as the dredging (removal), transport, placement in a constructed CAD cell, and design of a cap was technologically achievable at that time.

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ATTACHMENT 1 TO COMMENTS OF DR. ENGLER

Summary of Contaminated Sediment Capping Projects.
Hazardous Substance Research Centers/South & Southwest.
Georgia Tech Research Corporation. Atlanta, GA. Sed Web. 2006.

Summary of Contaminated Sediment Capping Projects

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
<i>Puget Sound/Washington</i>										
1	Duwamish Waterway Seattle, Washington (CAD)	Heavy metals, PCBs	Existing 6-ft. deep subaqueous depression; Waterway depth 70 ft.	3 ft. design target; 2 ft. actual average after consolidation (21)	Sand (4,000 cy)	1.3 acres estimated (a) 0.7 acre original cap size (21)	1984	Functionally no erosion (a small amount of cap eroded from one side to another, but was then covered by natural sedimentation) (21) No chemical migration observed in second and third coring operations (21) Concentrations of heavy metals and PCBs were at least an order of magnitude lower in the sand cap than in contaminated material below (22) The 18-month and 5-yr sediment chemistry sand-cap concentrations matched almost exactly (22) Interface between contaminated and cap sediments was sharp and relatively unmixed (22)	First capping project (a "learning experience") in EPA Region 10 Led by the USACE with limited involvement from EPA (21) Key lessons learned: relationship between contaminated sediment fill volumes, CAD cell size, and rate of CAD filling (21) Split-hull dump barge placed sand over relocated sediments in CAD cell (A) Maximum sustained bottom currents: 0.2 ft/sec (occasional readings in the upper water column approaching 1.0 ft/sec) (23)	A, E, F, 21, 22, 23
2	One Tree Island Olympia, Washington (CAD)	Heavy metals, PAHs	Marina; 14.8 ft. deep	4 ft. (in order to obtain a consolidated cap of 3 ft.) (21)	Sand Clean sediment (E)	0.5 acres	1987	Applied lesson from Duwamish: allow contaminated material to consolidate on barge and then to settle in CAD cell (1 - 2 weeks) (21) Little prop scour; recreational divers said that cap appeared to be intact (21) No chemical migration (A) No erosion of cap (A)	First permitted CAD project (21) Maintenance dredging of a marina; top 2-3 ft. of contaminated sediments were dredged and placed in "overbuilt" (or "very deep") CAD cell in marina (21) No ongoing monitoring required (21) Last monitoring occurred in 1989 and showed that sediment contaminants were contained (A)	A, C, E, 21

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
3	St. Paul Waterway (Simpson Tacoma Kraft Superfund Site) Tacoma, Washington (ISC and habitat restoration)	Phenols, PAHs, dioxins, furans	Shallow, near shore sediments, 11.5 ft. deep Depth now is -20 ft. MLLW at extreme (21)	2-12 ft. 4.9-19.7 ft. actual (B, E) 3.9 ft. design (E) 3 - 13 or 14 ft. (36)	Coarse sand from Puyallup River	17 acres (11 acres of marine sediments capped; 6 acres of new intertidal habitat built along shoreline) (32)	1988	Intensive monitoring conducted annually for 10 years (36) Monitoring recently scaled back; cap will be checked every other year to ensure that it is still in place and that the elevation has not changed substantially; cap will be checked after any major storm or earthquake (36) Everything is working fine; no chemical migration; cap still within specifications (A,21,36) PRP won environmental award for habitat creation (21) > 10 years of chemical and biological monitoring show contaminated sediments have remained confined and isolated beneath cap and cap is providing good habitat for estuarine biota (32) St. Paul Waterway was delisted from the NPL on 10/29/96 (32)	First designed and permitted capping project under Superfund regulatory process (21) Some redistribution of cap materials occurred, but overall design level met (36) C.californicus (typical deep burrowers that can cause bioturbation) found in sediments, but never at depths >1 m (3.3 ft.) (A); bioturbation would have been limited (21)	A, B, C, E, 21, 32, 36
4	Pier 51 Ferry Terminal Elliott Bay Seattle, Washington (ISC)	Mercury, heavy metals, PAHs, PCBs, PCDF	Docks at 20-25 ft. 60 to 100 ft. (at approx. 150 ft. from shore)	Docks: 4 ft. design (to achieve 3 ft. consolidation) (at water depths of approx. 35 ft. Rest of Site: 1.5 - 2 ft. design (to achieve 1 ft. consolidated)	Coarse sand	4 acres (2 acres with thick cap; 2 acres with thinner cap)	1989	No chemical migration (A) Cap within specifications (A) Recolonization observed (A) As recent as 1994, cap thickness remained within design specifications (A) While benthic infauna have recolonized the cap, there is no indication of cap breach due to bioturbation (A) For 1 or 2 years, the thinner cap was not as clean as the original cap, possibly due to mixing; the thicker cap remained clean (21) No ongoing monitoring required (21) Caps worked very well (21)	Project was primarily an experiment to see if ferries would blow the cap away (hence thicker cap employed at the ferry area) (21) During reconstruction of ferry terminal, a piling was pulled up, recontaminating the cap with creosote - cap was repaired (21) Cap was recontaminated in top ~2cm with metals; fate and transport study demonstrated that ferry terminal was at nexus of two gyres (from north and south); this knowledge partially dictated subsequent cleanup efforts (21)	A, E, 21

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
5	Denny Way CSO Elliott Bay Seattle, Washington (ISC)	Heavy metals, PAHs, PCBs	Water depth 18-50 ft.	2-3 ft.	Sand Sandy sediment from Duwamish Waterway	3 acres	1990	1994 cores showed recontamination in cap surface, but no migration of chemicals through cap (A) Recontamination likely from CSO (21)	CSO once discharged primary sewage; now discharges storm water and wastewater from some wastewater treatment plants (21) An original project goal was to study rate of recontamination at cap surface using a mass balance approach; found not to be possible (21)	A, B, C, E, 21
6	Piers 53-55 CSO Seattle, Washington (ISC)	Heavy metals, PAHs, PCBs	Similar to those at Pier 51 (21)	1.3-2.6 ft. (A) Similar to those at Pier 51 (21)	Sand Material from Duwamish Waterway (E)	4.5 acres	1992	No chemical migration Cap stable, and increased by 15 cm (6 in.) of new deposition Gyre caused sediments to erode from cap, but remaining cap seemed stable (although materials were spread around a lot) (21) Accretion zone (21) Difficult to discern volumes from consolidation vs. erosion (21) Infaunal communities returned changed; much more shading after cap placement (21)	Material sprayed under existing piers to form cap (21) Pre-cap infaunal communities were destroyed in the rapid burial associated with cap construction (A) Constituents from adjacent sediment site have been deposited in cap surface (E) The amount of sediment accumulation was not anticipated; the ferry terminal creates a quiescent area, causing sediment dropout (21)	A, E, 21
7	Pier 64 Seattle, Washington (ISC)	Heavy metals, PAHs, phthalates, dibenzofuran	Water depth 20-59 ft.	0.5-1.5 ft.	Sand	32.1 acres (E) 4 acres (NN)	1994	Some loss of cap thickness in western portion; reasons unclear (erosion or consolidation/settling) Reduction in surface chemical concentrations noted Post capping water column monitoring showed concentrations of metals and organics to be below pre-capping concentrations (NN)	Thin-layer capping used to enhance natural recovery and reduce resuspension of contaminants during pile driving (A) A pier expansion project; old creosote-covered wood pilings replaced with concrete pilings, which are further spaced, allowing more light and more habitat (although still have issues with shading) (21) Capping placed under and in front of pilings (21)	A, E, NN, 21

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
8	GP Log Pond Whatcom Waterway Bellingham, Washington (ISC and beneficial habitat creation)	Mercury, phenols	Conversion of deep subtidal, shallow subtidal mudflat/debris and low intertidal riprap ; -5 ft MLLW (31)	Phase 1: 0.5 to 3 ft. Phase 2: 0 - 6 ft. Total: 0.5-10 ft. (31)	Phase 1: Coarser sand dredged material Phase 2: Finer- grained navigational dredge material (31)	5.6 acres (31)	Nov. 2000 to Feb. 2001 (31)	No chemical migration at 3 months (A) Cap successfully placed (A, 31)	Interim Remedial Action under authority of State Model Toxics Control Act Cap surface constructed using substrates and elevations to create beneficial use habitat Full sediment removal was not practical because: (1) dredging with high amounts of debris would cause significant impacts to the water column, (2) dredging could have compromised integrity of containment structures (nearshore fill) for other hazardous substances, and (3) existing docks, dolphins, and shoreline structure present within or adjacent to the Log Pond would likely have been adversely impacted by a full removal action (31)	A, M, 21, 31

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
9	East Eagle Harbor/Wyckoff Bainbridge Island, Washington (ISC and intertidal habitat creation)	PAHs (36)	Phase I: contaminated subtidal harbor sediments capped Phase II: contaminated nearshore sediments capped Water depths 0-45 ft. (36)	Phase I: 3 ft. (36) Phase II: 3 ft. (36)	Phase I: Clean river sediment (275,000 cy) Phase II: Upland fill (clean sand) (120,000 cy) (28) Phase III: upland fill (80,000 cy) (36)	Phase I: 54.4 acres (E) Phase II: 15 acres (36) Phase III cap on Phase II area (slightly smaller footprint) (36)	Phase I: 1993-1994 Phase II: 2000-2001 Phase III: 2001-2002	No chemical migration Cap erosion measured within first year of monitoring in area near heavily used Washington ferry dock After Phase I cap placement, pools of creosote were observed at cap edges; pools likely migrated from Phase II/III area, which was not contained at the time; divers extracted the pools regularly (36) Ongoing monitoring planned for another 10 years; then, more monitoring likely (36) Ongoing releases from ferry parking lot and other upland sources (36) Cap is working very well; monitoring shows that cap is staying in place and is preventing chemical migration; the agency is very happy with the cap (36) NOAA study documented rapid and substantial increase in quality of habitat (36)	Phase I objective: reduce immediate risk (28) Additional remediation delayed until upland source control achieved (the fall 2000 installation of sheet pile wall) (28) Phase II objective: extend cap from 1994 cap's approx. 2-ft. thickness contour (about 900 ft. offshore) to northern shoreline of Wyckoff facility (and to coordinate with construction of new intertidal habitat area on western portion of site) (28) Phase III objective: place 80,000 cy clean sediment to build an intertidal area connecting Phase II area to north shoal (28) and to add more confinement material to the cap (36) Just finished placing the Phase III material in mid-February 2002 (36) There is now a huge area that provides intertidal habitat for endangered species (36)	A, B, D, E, 28, 36
10	West Eagle Harbor/Wyckoff Bainbridge Island, Washington (ISC)	Mercury, PAHs	Water depth 0-45 ft.	Thin cap (0.5 ft.) over 6 acres Thick cap (3 ft.) over 0.6 acres	Quarry sand (22,600 tons for thin cap and 7,400 tons for thick cap)	6.6 acres	Partial dredge and cap 1997	No chemical migration Post-implementation surveys identified 16 discrete cap areas lacking in minimum thickness, so another 1,000 cy added (NN) (EPA will check this statement)	To date, post-verification surface sediment samples have met the cleanup criteria established for the project Ongoing monitoring Cap has achieved its intended function and is doing well (36)	A, NN, 36

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
11	Middle Waterway Commencement Bay Nearshore/Tideflats Superfund Site (CB/NT SS) Tacoma, Washington	Mercury, PAHs, PCBs (21)	Original shoreline and mudflats; completely intertidal; high tide depths: about 13-15 ft. where capped (21)	2-3 ft. (related to habitat design) (21)	To be determined (48)	3.95 acres of thin layer cap and 0.24 acres with 3 ft. cap (per draft 8/01 document) (30)	Scheduled for early 2003		April 1997 Consent Order The project just entered the "Remedial Design Phase", a significant portion of which will involve capping (21) A few portions will be dredged because of navigation requirements (21) Remedy includes dredging with near-shore-confined disposal, monitored natural recovery, thin-layer capping and thick capping (30)	GG, 21, 30, 48
12	Thea Foss Waterway CB/NT SS Tacoma, Washington	PAHs, phthalate esters, trace metals, PCBs (46), dioxins (21)	8000-ft. waterway; depth is about 15 ft. now; depth in main channel may be restored to 20-25 ft.	3 ft. for thick caps (50) possibly 0.5 to 1 ft. for thin caps	To be determined	Approx. 20 acres (46, 50)	To be constructed (EPA's selected remedy)	The in-situ cap will be thick enough to contain and isolate contaminated sediments in situ from the overlying water column and habitat, and will be thick enough to resist erosion from vessel scour, wave action, or penetration by burrowing organisms (46) 100% design expected to be complete in March 2002 (50)	1994 EPA Consent Decree with City of Tacoma Project focus is not on habitat, although benefits to endangered species habitat will be considered (21); 14 acres of intertidal habitat are proposed (46) A portion of each of the project's 8 sediment management areas (SMAs) will be thick-capped; the SMA at the head of the waterway will also employ sorbent capping to control oil seepage (46) Enhanced natural recovery to be used at mouth of waterway (50) Majority of sediments in navigation channel will be dredged (50)	21, 46, 50

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
13	Olympic View Resource Area CB/NT SS Tacoma, Washington	Dioxin	Intertidal area with a small subtidal area; water depth is -15 ft. MLLW	4 ft.	Erosion protection layer over 43 in. clean sand over geotextile barrier over 6 in. TOC material	1.0 to 1.6 acres	Construction began in June 2002		Approved non-time critical removal action (no ROD) Highest dioxin concentrations in area Site covers 12 acres, but 2.2 acres (review with EPA) will be remediated Approximately 51,000 sq. ft. will be excavated down 1.1 ft and backfilled with clean material. The other portion (1.0 acres or 68,290 sq. ft.) will be capped (review with EPA)	10
14	General Metals of Tacoma Hylebos Waterway CB/NT SS Tacoma, Washington (ISC)	Metals, PAHs		3 ft.	Sand, gravel, geotextile liner	800 feet along shoreline under piers	Late 1990s	Recent monitoring indicates that cap is functioning as designed	Capping conducted in conjunction with repair work on dock/bulkhead structure by General Metals Capping selected because dredging presented concerns about undermining dock structural integrity	49
15	Occidental Chemical Removal Action Hylebos Waterway CB/NT SS Tacoma, Washington (trial cap)								Message left with EPA Region 10	49
16	Asarco Sediments/ Groundwater Operable Unit 06 CB/NT SS Tacoma, Washington (pilot)	Arsenic, lead, copper	Near old smelter site	30 cm and 60 cm (side by side)	Clean river sediments			Pilot cap was very successful	Pilot study was conducted to determine if cap would remain in place and become recolonized with healthy biological communities	51

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
17	Asarco Sediments/Ground water Operable Unit 06 CB/NT SS Tacoma, Washington (full-scale)	Arsenic, lead, copper	Near old smelter site; cap will be 0 - 60 ft. deep	3 ft.	To be determined	18 acres	To be constructed (ROD signed in July 2000)		Entire yacht basin will be dredged (about 20 acres) Offshore contaminated sediments will be capped Draft 30% design completed Cap will integrate into armored shoreline (2/3 of armor has been placed) Entire peninsula created by pouring arsenic-containing slag into the water, (slag is 100 feet thick in places); dredge volumes would have been too great so it was determined to isolate contaminants from benthic organisms by using a 3-foot-thick cap	51
18	Lockheed Shipyard Duwamish River/Elliott Bay Seattle, Washington	Primarily arsenic, lead, mercury, zinc, copper, some PCBs and PAHs	Navigable river; major salmon route; water depth ~ 20 ft.	2 ft. minimum (ROD) 3.5 ft. currently under consideration	To be determined	Approx. 15 acre (based on 3.5 ft. cap and 85,210 cy of cap material)	Possible pier removal this winter; dredging and capping may begin in the fall or winter of 2003		A huge pier will be removed; that area will be dredged and then capped to prevent contaminant migration and to improve aquatic habitat Area beyond current pier will be dredged but not capped Design has not been finalized Capping is part of remedy per ROD	58
19	Todd Shipyard Duwamish River/Elliott Bay Seattle, Washington	Primarily arsenic, lead, mercury, zinc, copper, TBT, some PCBs, PAHs	Navigable river; major salmon route; very steep slopes (drops from 30 to 50 depths rapidly)	To be determined	To be determined	To be determined	Dredging and capping may begin in the fall or winter of 2003		A more involved project than Lockheed; this is still a working shipyard and site has steep slopes Design has not been finalized Capping is part of remedy per ROD	58

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
20	Puget Sound Naval Shipyard Bremerton, Washington (CAD)	PCBs, mercury (48)	Depth varies; approx. 30 ft. at CAD (48)	Approx. 1 ft. (interim cap) and approx. 3 ft. (second cap), for total of 4 ft. before consolidation (48)	CAD cap: clean dredged material from turning basin (48)	CAD: approx. 10 acres (48)	Dredging completed in June 2000 Final CAD cap placed in Sept. or Oct. 2001 (48)	Pit CAD sized properly (deep and wide) but experienced some "slop" (2-3 cm extending 20-50 ft. out) (21) Key lesson learned: awareness of differences between "production" project and "environmental" project; apparently the project experienced bucket overfilling, overdredging, and underdredging, possibly causing problems with water quality (turbidity) (X) The project went very well (48) Monitoring plan is being developed now (48)	Project involved dredging of channel and turning basin, and pier extension and reconstruction Remedy included dredging, on-site disposal in CAD, thick and thin-layer capping, and natural recovery (29, 48) Project unique because of significant volume of contaminated sediment (>390,000 cy), tight schedule, significant daily tidal exchange, water depth and CAD pit volume constraint (required precision dredging) (X)	X, 21, 29, 48
21	Pacific Sound Resources Seattle, Washington	PAHs, mercury, PCBs (33)	Old creosote plant located at mouth of Duwamish River; intertidal area to depths >240 ft. (33)	5 ft. in intertidal areas to -10 ft. MLLW (33) Other areas: to be determined (33)	Navigational dredged material or upland borrow intended (33)	Capping selected for 50-65 acres in remedial design (33)	ROD signed; pre-work (e.g., pilings removal, small dredge area) likely in 2003; capping possibly in 2003	Approximately 20 acres of cap are on an 18-21% slope (33) Cap likely designed to require repair after a significant earthquake (33)	Remedy is mostly capping In navigation channel, a depression to the lone dock (at area near former plant outfall) will be dug; those spoils will be consolidated onshore (21) A beach will be built, with 5 ft. cap to tie into shoreline structure and habitat and to sequester contamination; thinner cap (6 inches) may be used away from shore (21)	21, 33
California, Oregon, and other Western States										

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
22	Port of Los Angeles Shallow Water Habitat (PSWH) Los Angeles, California (CAD and habitat creation) (the "Pier 400 project")	Heavy metals (esp. copper), PAHs, DDT, PCBs; a "historic soup"; large storm drain discharges to the area (38)	Bay not used for navigation; depth reduced from 40 ft. to 15 ft. to create habitat	15 ft.	13 ft. clean harbor material; 2 ft. clean sand (latter was habitat-driven)	94 acre CAD (FF) within 192-acre site	1995	Project performance fine to date (27, 37, 38) Recent discussions about possible expansion (27); expansion does include capping of any other contaminated sediments, but rather entails creation of 54 more acres of habitat (38) No long term monitoring required (38) 1993/94 monitoring showed that the cap was still in place (38)	Overall effective cap was >15'. The thick cap was a result of site geometry and dredging volumes and was not required to prevent contaminant migration (FF, 38) First CAD project in California for contaminated sediments (27) A perimeter subaqueous berm was placed prior to placement of 5 million cy of contaminated sediments (27) Provides habitat for endangered species (California lease term) (27, 38) Cap covered a designated "hot spot" (38)	A, FF, 27, 37, 38
23	Port of Los Angeles Shallow Water Habitat (PSWH) Los Angeles, California (pilot CAD)	Lead, zinc, copper		12 ft. (OO)	Sand cap over 44 geotextile containers filled with contaminated sediments	est. 10 acres ^(b)	Dredging from Nov. 10, 1994 to Dec. 18, 1994		66,000 cy contaminated maintenance dredged material from Marina del Rey and Ballona Flood Control channels were placed in geotubes	O, FF, OO, 27

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
24	Convair Lagoon San Diego Bay San Diego, California (ISC with foraging habitat creation)	PCBs	Water depth 10-18 ft. 10-acre site	2 ft. sand over 1 ft. rock	Sand over crushed rock and geogrid	5.7 acres	Oct. 1996 to mid- 1998	No chemical migration Cap successfully placed in very shallow water Some chemicals observed in cap Could expect to see some chemicals in cap because of high energy environment (similar to Elliott Bay experiences) (27)	State-ordered remediation of PCBs (27) Ongoing monitoring for 20 to 50 years (includes diver inspection, cap coring, biological monitoring) Designed to withstand a significant seismic event 4 acres by shore and outfall had high localized concentrations of PCBs, so agency did not want to dredge, but instead required a cap (thin enough to preserve salt water habitat but thick enough to withstand high energy environment) EPA wanted geotextile layer to stop burrowing shrimp; somehow, geogrid was installed instead (27) Some disagreement on PCB action level between agencies; EPA convinced project team to cap greater area with clean sand (27)	A, E, 27

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
25	North Energy Island Borrow Pit Capping Pilot Study Long Beach Harbor, California (pilot CAD)	DDT, metals, PAHs, others (47)	Borrow pit created as result of construction of energy islands (47) Flat pit bottom, 52 to 66 ft. deep 0.5 mile offshore of Long Beach (47)	3 ft. minimum required (47) 4.9 ft. max. (47)	Clean silty sand dredged from entrance to Long Beach Harbor (47) 100,000 cy of contaminated sediment from the LA River estuary were deposited (37) in one segment of the pit that was already segmented by berms from a water line (47)	9.9 acres (47) Entire Pit: 220 acres approx. (c)	disposal in Aug. 2001 (47) cap construction completed in Dec. 2001 2-3 more years to study the pilot CAD cell (37, 47)	Construction phase report expected in March Pilot CAD cell to be closely studied (e.g., coring, benthic, bathymetry) over next 2-3 years One of the biggest questions is the degree of bioturbation that will occur (37) Fine silts in the pit bottom and clays consolidated very quickly, making it difficult to account for all material (47) Monitoring plan is being developed now (47)	The LA Contaminated Sediments Task Force is evaluating several contaminated sediment disposal options for the region, including use of CAD cells; no judgement has been made to date and will not for at least another 2-3 years (37, 47) USACE is performing an EIS for this 1st multi-user CAD site, which will cap up to 7 million cy of contaminated sediments with clean sediment; several engineering issues being considered (e.g., separate cells vs. layering of project sediments); several other issues being considered (contaminant limits, maximum duration of exposure) (27) One pilot study was conducted that pertained to capping; other pilot studies were conducted that address other engineering topics (47)	P, 27, 37, 47

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
26	Palos Verdes Shelf San Pedro, California (pilot ISC)	DDT and PCBs	17-sq.mi. continental shelf and slope (34)	Cell LU: 15-45 cm Cell LD: <10 cm Cell SU: 15 cm	Clean sediments (two types)	135 acres (made up of three 300 x 600 m areas)	Aug. 2, 2000 to Sept. 14, 2000	<p>Preliminary Results (Ref. H):</p> <p>Disturbance of contaminated sediments was relatively localized and decreased substantially after the initial load was placed</p> <p>Sediment plumes caused by capping did not pose a risk to near shore kelp beds</p> <p>Spreading was less disruptive than conventional placement</p> <p>There were no indications of mass sediment movement (such as mud waves or turbidity flows) as a result of capping</p> <p>The pilot study went well; all indications show cap was successfully placed; monitoring continues, and indicates possible transport of contaminated sediments to cap from uncapped areas; more coring will be conducted to study this (34)</p>	The final report for study may be issued in March, 2002 (34) 9/28/01 Action Memorandum (Ref. I) proposes establishing institutional controls (outreach & education, monitoring and enforcement) associated with consumption of contaminated fish EPA continues to evaluate in-situ capping and other remedies and may issue proposed alternatives by year-end, 2002 (34)	G, H, I, 34
27	McCormick and Baxter Old Mormon Slough Stockton, California	Dioxins, PAHs	Dead-end waterway; 10 ft. deep; maintenance-dredged for barge access; tidally influenced	2 ft.	Sand	8.8 acres	Construction may begin in 2002 (35)		ROD signed 4/99 Capping selected because site is at the end of a dead-end slough, so cap is unlikely to wash away (35)	AA, 35
28	McCormick and Baxter Willamette River Portland, Oregon (ISC)	Heavy metals, PAHs	15 acres of near shore sediments and soils; depths to 35 ft.	3 ft.	Sand	15 acres (S) Cap may take 17 to 22 acres, depending on how thickness will vary (21)	Aiming for construction in 2004 (21)		Long-term monitoring, OMMP, and institutional controls were also specified (A) Cap being redesigned now (recently decided to install a piling wall around upland site to contain NAPL on site, thereby preserving treatment options in the future -waiting to see how Eagle Harbor wall performs) (21) Habitat will be considered, particularly for juvenile salmon (21)	A, E, S, 21

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
29	Ross Island Lagoon/ Port of Portland Portland Oregon (CAD)	Metals, TBT, PAHs, PCBs (41); some COCs more prevalent in certain cells (57)	lagoon; no significant current (57); first CAD cell depth: ~80 ft.; other CAD cell depths: 0-30 ft. (57)	1 ft. (41) 1 ft. minimum for Cells 1-4; 2 to 10+ ft. for Cell 5 (61) Some discussion in late 1990s about increasing cap thickness; details not provided (57)	Fine-grained material derived from on-site sand and gravel washing and processing operations (39) Material from Ross Island rock crushing settling pond (61)	8.4 acres ^(d)	Dredging from 1992 to 1998 Cell 5 was first to be constructed	OR DEQ accepted a Dec. 2000 study showing that contaminated sediments from Port facilities in capped disposal areas do not pose a threat to human health or the environment (40) CAD cells are working well; model developed from data predicts no exceedances of any water quality criteria in the next 500 years (57) A barge tipped over in 1998; the spilled material was covered with a 1-ft cap; a portion of the Cell 5 cap was breached and repaired in 1998 (57, 61)	In five Port dredging events from 1992 to 1998, ~ 160,000 cy of dredged material were transported to the lagoon for permitted confined disposal; RIS&G accepted, placed and capped the in-water containment cells (39) 4 cells accepted material from navigational dredging; 1 cell accepted material from the Port of Portland's Pencil Pitch spill (57) Some discussion about lowering dike between two islands; current hydrology study is studying possible effects on cap integrity (57)	D, T, 39, 40, 41, 57, 61
30	Inlet Basin Soda Lake, Wyoming (case study)	PAHs, benzene, metals, NAPL	Natural playa basin, 2-12 ft. deep; recharges each year by runoff and dries later in the year (H)	1.5 ft.	Native sand	5.6 acres	Before June 15, 2000 and Aug. 31, 2000	After 3 months, the upper 2 feet of cap contained no organic contaminants in excess of screening levels Short-term effects from cap placement were minimal Long-term integrity also evaluated	The Draft Final Remedy Decision dated Oct. 29, 2001 does not propose capping, but instead proposes excavation The WY DEQ concluded that the best alternative would be to excavate the sludge and place it in a lined corrective action management unit. Capping was not implemented. (17)	H, L, 17
Great Lakes										
31	Upper River section Sheboygan River, Wisconsin (pilot)	PCBs	9 hotspots totaling 1,200 sq. yds.	1 ft. of coarse material and upper geotextile over lower geotextile fabric	Armored stone composite	0.25 acre	1989-1990	No monitoring data Cap appears to be intact with significant silting-over and thus additional stabilization Undetermined cap effectiveness Some erosion of fine-grained material	Composite armored cap required because of location in high-energy river environment. Gabions placed at corners for anchoring. Additional coarse material placed in voids and gaps. A 1990 bench-scale armoring study by Enseco, Inc. indicated that capping had a significant effect on reducing PCB concentration measured in exposed aquatic organisms (E).	A, E, D

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
32	Areas C and D Manistique, Michigan	PCBs		2.7 ft.	Composite	17 acres	Planned, but not implemented (site remediation was dredging)	Project not built	Composite cap over a 17-acre site includes armoring and geotextiles	A
33	Manistique Capping Project Michigan (ISC)	PCBs	Shoal in river with depths of 10-15 ft.	40-mil (0.1 ft.)	HDPE	0.6 acre	1993	Physical inspection of temporary cap approximately 1 year after installation showed cap to be physically intact with most anchors in place	A 240 ft. by 100 ft. HDPE temporary cap was anchored by 38 2-ton concrete blocks placed around the perimeter of the cap. This temporary cap was installed to prevent erosion of contaminated sediments within a river hotspot with elevated surface concentrations	A, B
34	Hamilton Harbor Ontario, Canada (ISC demonstration)	PAHs, metals, nutrients	Lacustrine waterbody	1.6 ft.	Clean sand	2.5 acres	1995	Significant reductions in the flux of site contaminants were observed after capping (D)	Capping selected because of impracticality of dredging and upland disposal due to large sediment volumes (E)	A, B, D, E
35	Madison Metropolitan Sewerage District Lagoons Madison, Wisconsin	PCB (greater than 50 mg/kg)	2 sludge lagoons in wetlands 141-acre site	1 ft.	Geotextile and lightweight soils			Planned in ROD	According to the ROD (dated March 31, 1997), the final site remedy includes the segregation and in-situ containment of sludge with PCBs > 50 mg/kg. The soil will be seeded.	E
36	Oxbow Lake near Rib River Wausau, Wisconsin (ISC) ("Snow Cap" project)	Lead	Shallow, 4-acre oxbow lake at former battery reclaiming site; important breeding habitat for small fish		4-layer composite cap (geotextile and sand blanket, w/ 2nd layer of geotextile and rock "islands"); then snow		Winter, 1997, to take advantage of snow and ice	Data from 5 locations during Mar. 1999 found current lead concentrations in the water column to be at background or non-detect levels. Benthic organism populations noted in shallow water; vegetation becoming established on the new substrate	This new method cost significantly less than "conventional (and environmentally invasive) sediment dredging in terms of both funding and time resources". The technique offers the advantage of providing a safe habitat for existing fish populations. The approach costs one-third the cost to remove sediments	V

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
37	Ottawa River Toledo, Ohio (ISC Demonstration)	PCBs	0.2 mile stretch; estuary with low flows; 8 ft. deep	0.33 to 0.66 ft.	AquaBlok™ (clay-mineral aggregate), with or without geotextile	2.5 acres	1999	Monitoring results limited (E) Ohio EPA completed a benthic community study before AquaBlok™ application and found the site to be sterile; there are plans to conduct a follow-up study in 2001, but improvements may not be seen because of ongoing contamination from a nearby Superfund site (45)	The goal of the demonstration was to assess application methods, not necessarily provide permanent remediation (45) The Ottawa River has a 100-year flow velocity of 4.8 ft/sec for approx. 1 hour. Flume tests of similar AquaBlok™ compositions withstood water velocities of 6 ft/sec for 50 hours with an approximate 10% loss. (45)	E, 45
38	Triangle Pond Tommy Thompson Park Downsview, Ontario	Lead, iron, oil & grease	Man-made water body in park	1.6-9.8 ft. design 6.6-13.1 ft. actual	Clean sand and fill	2 acres	1999			C, O, U
<i>New England/New York</i>										
39	Stamford-New Haven-N New Haven, Connecticut (Central Long Island Sound (CLIS) area)	Metals, PAHs	Flat bottom ~65 ft. deep	1.6 ft. (A) Up to 7-10 ft. (F)	Sand		1978	No chemical migration 11 years of monitoring show this to be one of the most stable mounds	Cores collected in 1990 Contaminated sediment from Stamford Harbor was capped with slightly less contaminated material from New Haven Harbor (FF)	A, F, FF
40	Stamford-New Haven-S New Haven, Connecticut (CLIS area)	Metals, PAHs	Flat bottom ~70 ft. deep	1.6 ft. (A) Up to 13 ft. (F)	Silt		1978	No chemical migration 11 years of monitoring show this to be one of the most stable mounds	Cores collected in 1990 Contaminated sediment from Stamford Harbor was capped with slightly less contaminated material from New Haven Harbor (FF)	A, F, FF

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
41	New York Mud Dump Disposal Site (a.k.a. "New York Bight" or "Long Island Bight")	Metals in silt and clay dredged from 6 projects in NY Harbor (E)	Flat bottom 80-90 ft. deep (F)	3-4 ft. avg. 5-9 ft. max.(F)	Mud (120,300 cy) Sand (1,200,700 cy) (E)		1980	No chemical migration	Cores taken in 1993 (3.5 years later) showed cap integrity over relocated sediments in 80 ft. of water (A) Simultaneous with the Mud Dump Site closure, the site and vicinity will be redesignated as the Historic Area Remediation Site (HARS) A portion of HARS will be remediated, with approximately 1 m of capped clean dredged material (E)	A, E, W
42	New York Mud Dump Capping Project New York, New York (CAD)	Trace dioxin	Open water sediment disposal site (500,000 cy)	3.2 ft.	Clean sand		1993-1994	Long-term monitoring being conducted Engineering of cap construction considered a success		D
43	Historic Area Remediation Site (HARS) (former Mud Dump region)	PAHs, PCBs, DDT, dioxin, metals	HARS is 15 sq. nautical miles; water depths: 40 - 138 ft.	3.2 ft.	Relatively clean dredged sediments	9.0 square nautical miles (7638 acres)	To be constructed		Required under proposed rule in 40 CFR 228	LL, MM
44	Mill-Quinnipiac River (MQR) Connecticut (CLIS area)	Metals, PAHs	Flat bottom ~65 ft. deep	1.6 ft. (A) 6-10 ft. avg. (F) 4.9 ft. as of 8/91 (PP) 9.8 ft. as of 9/93 (RR, SS)	Silt	10.7 ^(c)	1981-1982 1982-1983 1993-1994 (SS)	Due to slow, retrograde recolonization rates, cores were collected in 1991 -showed presence of PAHs in the cap (PP) One year later, benthic improvements were noted (QQ) In Sept. 1993, more cap material was placed. July 1994 monitoring showed that the mound height had increased by another 1.5 m, the diameter had not changed, and recolonization rates met or exceeded the targeted rates (RR) Small to moderate pockets of consolidation near the apex and SW flank were noted (SS)	PAHs were not included in the protocols in 1982 when the first cap was placed. (PAHs were included in the protocol starting in 1989).	A, F, PP, QQ, RR, SS
45	Norwalk, Connecticut (CLIS area)	Metals, PAHs	Flat bottom ~65 ft. deep	1.6 ft. (A) up to 6-7 ft. (F)	Silt		1981	No problems	Routine monitoring	A, F

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
46	Central Long Island Sound Disposal Site (CLIS) Long Island, New York	PCBs metals, oil & grease	Multiple sediment disposal mounds	20 -41 cm (A) 0.5 - 3 ft. typical (PP, QQ, RR, SS)	Course sand and shell fragments	Varies	1979-1983 (A) Continued well into the 1990s (SS) and probably still active	Some cores show uniform structure with low-level chemicals and others show no chemical migration Some slumping noted (A) As of 1996, no evidence of particle re-suspension or cap erosion; stable benthic communities over the majority of stations sampled; effects of seasonal hypoxia recognized at other stations (SS)	Extensive coring study at multiple mounds showed cap stable at many locations Poor recolonization in many areas Most cap elevation changes due to consolidation, not erosion Early 1990 coring results indicate that the cap layers continue to isolate contaminants from water column (B)	A, E, PP, QQ, RR, SS
47	Cap Site 1 Connecticut (CLIS area)	Metals, PAHs	Generally flat ~60 ft. deep	1.6 ft.	Silt		1983	No chemical migration	Cores collected in 1990	A, F
48	Cap Site 2 Connecticut (CLIS area)	Metals, PAHs	Generally flat ~56 ft. deep	1.6 ft. (A) 0.6-4.5 ft. (F)	Sand		1983	Required additional cap One of the more successful mounds	Cores collected in 1990	A, F, FF
49	Experimental Mud Dam New York (CAD)	Metals, PAHs		3.3 ft.	Sand		1983	No chemical migration; minor cap erosion (FF)	Cores collected in 1990	A, FF

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
50	New Haven Harbor New Haven, Connecticut NHAV 93 (CLIS area)	Metals, PAHs	Generally flat 60 ft. deep; part of a large-scale CAD project	1.6 ft. (A) 1.6 - 3.2 ft. (TT)	Silt	50.0 acres (UDM deposit itself) and 70 - 124 acres (total mound) (estimated from Ref. TT)	1993-1994	No chemical migration (A) July 1994 monitoring noted no major topographic changes and maintenance of minimum required thickness of 0.5 m (average thickness was 0.75 m along margins of the UDM deposit, and 1.25 m at center (RR)) Target recolonization rates were met or exceeded in most areas, except for three; Sept. 1994 tests demonstrated that cap supplementation was not required (RR) Aug. 1995-Sept. 1995 monitoring showed moderate amounts of consolidation (0.25 m over most of cap, and 0.5 m near center); 1996 monitoring noted 0.25 to 0.75 m of consolidation over majority of mound with little change in size or shape, and that benthic community continued to recover (SS)	From 1984 to 1992, contaminated sediments were disposed in 7 separate mounds that were located to form a ring (UU) In 1993, sediments from New Haven Harbor and five private marinas were placed in the middle of the ring and later capped. Significant consolidation was noted before capping took place(TT) Capping was completed by Mar. 1994 (RR)	A, FF, RR, SS, TT, UU
51	CLIS 94 Mound CLIS Area			1.6 to 3.2 ft.	Dredged material	43 acres ^(f)	Jan. 1995 to May 1995 (UU)	Sept. 1995 monitoring showed good benthic recovery despite added stress of seasonal hypoxia and recent impact of disposal (UU) July 1996 monitoring showed continued benthic recovery, higher dissolved oxygen and several pockets of consolidation at apex (0.25 to 0.5 m) (SS)	This mound forms the beginning of the second placement ring which will eventually become a CAD This mound completely envelopes the CS-90-1 mound (UU)	SS, UU
52	CLIS 95 Mound CLIS Area		Small, capped, dredged disposal mound	5.2 ft. (estimated from volume and area) (SS)	Dredged material	7.8 acres ^(g)	Sept. 1, 1995 (SS)	Rapid recolonization of sediments observed (SS)	Slightly irregular shape, due to bottom slope and distribution of capping material (SS) The CDM:UDM ratio is 3.1:1.0 (SS)	SS
53	Port Newark/Elizabeth Project New York	Metals, PAHs, low levels of dioxin (FF)		5.3 ft. 1 m design(FF)	Sand	198 ^(b)	1993	No chemical migration	Extensive coring study	A, FF

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
54	52 Smaller Projects New England	Metals, PAHs		1.6 ft.	Silt		1980-1995	No chemical migration	Routine monitoring	A
55	New London Disposal Site, Thames River, Connecticut		49 ft. deep	Irregular, 10 to 70 cm	Clean sediment		1988-1989			C, FF
56	S-90-1 Harbor Village/Branford River (CLIS area)		Generally flat 60 ft. deep	Incomplete coverage; several distinct cap mounds 0.6 to 2 ft. thick			1989-1990			FF
57	Massachusetts Bay Disposal Site Massachusetts (Demonstration)		90 miles deep; 22 naut. mi ENE from Boston		Clean sediment					C
58	Portland Disposal Site Yarmouth, Maine	Metals, PAHs	177 ft. and deeper		Fine-grained dredged sediment & sandy material		Oct. 1991 to June 1992	Sediment chemistry data showed that the cap effectively isolates contaminants		VV
59	Portland Disposal Site Yarmouth, Maine (Demonstration Project)	Metals, PAHs	Deep water ocean disposal site; 210 ft. deep	1.6 ft. 0.7 ft. (WW)				Project showed that dredged material may be effectively placed, capped, and monitored at deep water disposal sites (WW)	"A tightly controlled, closely monitored deep-water demonstration capping project in which clean sediment was capped with 20 cm of clean sediment" (WW)	II, WW
60	General Motors Superfund Site St. Lawrence River Massena, New York	PCBs	11-acre near shore site; depth of river at cap no deeper than 4 ft. (XX)	1.5 ft.	Sand, gravel and armor stone	1.7 acre	1995	In 1999, armored cap appeared intact with minimal disturbance; no routine maintenance required; however, additional armor material added in 1998 to restore minor nearshore areas (D) The cap is working very well, based on yearly inspections. In the first year, minor repairs were required (more fill rock) (XX)	Capping used where repeated dredging failed As of 1996, cap has maintained its integrity as a whole. Direct comparison of pre-remediation fish data with post-remediation data is complicated by uncertainties about collection locations for the pre-remediation fish. There are data anomalies. (Z) Water velocities in the River range from 2.75 to 4.42 ft/sec (D) Cap consisted of sand, activated carbon and gravel (24)	B, E, Z, XX, 24

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
61	Reynolds Metals Co. Massena, New York	PCBs, PAHs, lead, other organics, other metals (60)					Nov. 2001 (59)		Message left with EPA Region 2 ROD abstract states that untreated sediment and treated residuals will be disposed onsite in the Black Mud Pond and that the Pond will be capped	59, 60
62	ALCOA Grasse River Massena, New York (Pilot study)	PCBs	Backwater to St. Lawrence River; approx. 20 ft. deep; study covered 750 ft. section (26)		Test materials: 1:1 sand/tops oil mixture granulated bentonite (clay) material AquaBlok TM (these 3 test materials were used alone or in combination) (26)	Approx. 7.5 to 8 acres (25)	July 9, 2001 to Oct. 19, 2001	Extensive monitoring conducted prior to, throughout, and after the capping pilot study work(26) The study concluded that a cap to cover the PCB-containing sediments can be successfully constructed in the Lower Grasse River (26) Optimal results achieved with a 1:1 sand/topsoil cap applied via a clamshell attached to a barge-mounted crane (26) Little apparent short-term impacts noted during pilot project; negligible water quality impacts; monitoring will continue in 2002 (26) Capping will be carried into the Feasibility Study, both singly, and in combination with other remedies (25)	Capping is one of the cleanup alternatives being evaluated for remediation of contaminated sediments in the Lower Grasse River The study was conducted to better understand how different capping materials could be installed on the river bottom using various placement techniques (26) Capping was performed in two phases: initial "Test Cell " to test potential materials and placement techniques; real-time results from the Test Cells were evaluated and select capping techniques and materials were then used in larger "Pilot Cells" (26) Steep side slopes were a particular concern (25)	15, 25, 26

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
63	Marathon Battery Superfund Site East Foundry Cove Marsh Cold Spring, New York (cap and habitat restoration)	Cadmium, nickel, cobalt	Shallow estuarine	1-2 ft. cover soil (11)	BentoMat (1 in. Bentonite clay between 2 layers of geotextiles, material expands when wet); 1-2 ft. of clean fill on top (11)	12 acres (11)	April 1995 (AA)	Increases in sediment Cd concentrations probably due to cyclic flooding of marsh during high tide (D) Several problems experienced (e.g., replanting difficulties due to ice (in first year, bad ice flow destroyed cattails), geese (which eat the young shoots), tidal velocities that prevent seed settling) (11) Snow fences and other measures implemented (11)	Highest contamination levels in East Foundry Cove Marsh near the plant's former outfall: 171,000, 156,000 and 6,700 mg/kg for Cd, Ni, and Co, respectively (12) Mean Cd concentration: 27,799 ppm (D) Sediments were excavated (average post-excavation concentration was approx. 25 ppm for Cd, with no sample exceeding 100 ppm cleanup goal) The area was subsequently capped to isolate residual Cd from hydrologic and biologic processes, and to restore habitat (11, 13)	D, AA, 11, 12, 13
64	Rhode Island Sound		108-115 ft. deep; <0.5 ft/s bottom currents	Irregular, with some bald spots <17.4 ft.	Compacted silts and sand					C
65	Boston Harbor Navigation Improvement Project Massachusetts (CAD)	Multiple	Mystic River: 40 ft. MLLW Chelsea Creek: 38 ft. MLLW 8+ ft. tide (8)	3 ft. for each CAD cell (8)	Clean sand from Cape Cod Canal	2.4 acres ^(h)	1997: 1 CAD Cell at Conley Terminal 1998-2000: 7 CAD cells in Mystic River, including one "Super Cell" 2000-2001: 1 CAD cell in Chelsea Creek (8)	Key lesson learned: allow the contaminated materials to consolidate for several months or more before capping (CC) Longest consolidation period was 200 days (8) Other lessons learned: how far cells could be filled before causing "slop out" (8) Corps originally planned to have 60 shallow cells, no deeper than 20 ft. each, but modified plan to have fewer, deeper cells (some as deep as 80 feet) (8)	40 to 60 ft. deep pits dug to contain contaminated sediments The Conley Terminal CAD cell was a test case and Boston's first capping project Because benthic community returned without cap, that CAD cell was not capped Lessons learned from that site were applied to subsequent CAD cells (8) Chelsea Creek CAD cell still has 50,000 cy capacity to be filled, so will probably remain uncapped for 5 years A vessel passage study was conducted to ensure that the deepest and most powerful ships in channel would not pull silt out- CAD cells performed quite well in tests (8)	J, T, CC, III, JJ, 8

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
66	Upper Acushnet River Estuary/ New Bedford Harbor Massachusetts (pilot CAD)	PCBs, heavy metals	Estuary; pilot test site was small cove north of Coggeshall St. Bridge; depth ranged from 0.0 to 0.5 ft. (MLW)	2 ft.	Clean sediment produced during pilot study	CAD cell measured 180 ft. by 140 ft. (25,200 sq. ft., 0.6 acre)	Jan. 1989 to Feb. 1989	Analysis of six sediment cores taken on June 22, 1989, revealed elevated levels of PCBs in the surface layers of sediment, indicating that capping efforts were unsuccessful. The results pointed out the need for a high degree of control on the positioning and movement of the discharge point within the CAD cell. The position of the diffuser within 2 feet of the contaminated sediment layer may have resulted in a mixing of sediments. A deeper CAD cell would allow the diffuser to be separated from the contaminated sediment layer while still remaining within the confines of the cell.	The pilot study evaluated three types of hydraulic pipeline dredges, and two types of disposal methods (CADs and CDFs) The bottom elevation of the CAD cell was approx. -6 ft. MLW; Within the 180 ft. by 140 ft. cross section, a 50 ft. by 50 ft. section had bottom elevation of -8 ft. MLW Suspended sediment and contaminant levels were elevated in the vicinity of the CAD cell compared to background conditions and other phases of the study (a silt curtain was not in use during monitoring) A statistically significant increase in contaminant levels was not detected at the Coggeshall Street Bridge	7
67	Providence River and Harbor Maintenance Dredging (CAD)	Various (6)	Channel depth 35 to 43 ft. now (6)	Target thickness 1 ft. minimum; 3 ft. desired (6)	Suitable sediments from lower in the channel (6)	308 acres (6)	Possibly Nov. 2002 or spring or summer 2003 (6)		Five CAD cells currently designed for the Upper River to contain 1.2 million cy of dredged material (subject to change) EPA is "on-board" with the project EPA comments of 10/01 pertaining to dilution and mixing zone water quality requirements (Ref. K) have been addressed; final Water Quality Certification is pending	K, 6
68	Pine Street Barge Canal Burlington, Vermont (ISC)	PAHs, metals, VOCs	Northern end (turning basin) depth is 8-10 ft.; Southern end depth is 2-3 ft.; possibly 2 ft. higher in spring (5)	Possible thickness is 1.5 to 2 ft. if sand is used; if geotextile is also used, thickness may be less (5)	Sand/silt, with or without geotextile (5)	5-6 acres of affected canal sediments and 2-3 acres of wetlands	To be constructed ; may be complete in 2003 (5)	ROD specifies a cap (5)	Original remedial action required dredging; local opposition, then public consensus, led to development of in-situ capping remedy	E, T, 5

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
69	Housatonic River, Upper 1/2 Mile General Electric Site Pittsfield, Massachusetts	PCBs	Water depth typically 3-4 ft. (can range from 2-10 ft.) (YY); average flow 105 cfs (AA)	1 ft. silty sand; 1 ft. armor stone (62)	Multi-layer river cap: geotextile, silty sand with >0.5 % TOC, geotextile, GeoGrid, armor stone (62)	possibly 2-3 acres, based on drawings in Work Plan (62)			<p>Purpose of cap/armor is to provide a chemical and physical barrier between the residual PCBs (after removal of contaminated sediment) and the overlying water (62)</p> <p>A 12-inch thick silty sand layer with a 0.5% TOC concentration is proposed for the majority of the area; in certain areas, a 6-inch thick silty sand layer will be installed where 1.5 ft. sediment removals is proposed; an 18-inch thick silty sand layer will be used in one area where deeper excavation is proposed (62)</p>	Y, AA, YY
70	Messer Street Gas Plant Winnepesaukee River Laconia, NH	PAHs	Depth at underground phone cables 10-15 ft.	1 ft.	Course gravel, similar to on-site conditions	<0.1 acre	2000-2001	<p>Project went well</p> <p>Too early to identify any issues</p> <p>Monitoring will be conducted where free product was removed and sediment excavated</p>	<p>Overall design relied more on excavation than capping ("stabilization")</p> <p>Stabilization was used primarily in one area where buried telephone cables cross the river</p> <p>Stabilization specifically not used if free product was present, area was subject to scour, or depth was less than 10 ft.</p> <p>Other isolated portions of the 18 separate remediation areas may have used stabilization</p>	4

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
71	Rahway River Linden, New Jersey	DDT, metals	RCRA Corrective Action at industrial facility		Nonwoven geotextile, native sediment, sand filter material, second geotextile layer, rip rap armor	0.5 acre		Cap construction is complete and has received final closure approval	Message left with the NJDEP	E
<i>Other Domestic Projects</i>										
72	Lower Mobile Bay Alabama (ISC) pilot		Open ocean thin layer disposal	1 ft. maximum	Silt maintenance dredged material	<10 acres	1988	Pre-, during, and post-project monitoring was conducted by the Mobile District (of US ACE), WES, and EPA Motile and non-motile organism impacts and recolonization and water quality were monitored Minimal impacts resulted, and organism levels were at pre-project levels in 6 months Project considered a success (16)	Energy sources: long wind fetch across Mobile Bay and surface wave energies from boats and natural conditions (16)	W, 16
73	Anacostia Watershed Prince George's County, Maryland (pilot)	PCBs, PAHs, pesticides, metals	15-20 ft. depths; near shore site with heavy propeller wash			10,000 sq.ft.	To be constructed (design should start this summer)	Full commitment made to conduct pilot study	Because there are a number of contaminated sediment sites on the Anacostia River, the entire watershed will be addressed in its entirety, with stakeholder input Final remedy anticipated to be reactive cap	14

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
74	Koppers Superfund Site Charleston, South Carolina (ISC)	PAHs, pentachloro-phenol, trace dioxin, lead, arsenic	Ashley River, intertidal system; 1,500 ft. reach; cap mostly in intertidal zone; under 6 ft. of water at high tide (18)	1.5 ft. minimum	Geotextile and minimum of 18 in. sand (18)	3 acres (18)	Dec. 2001 (18)		Originally, only sediments in the Barge Canal were to be capped, and enhanced natural sedimentation was to be used in the Ashley River Due to public concern with sheet piles surrounding property access, and agency's desire to avoid delays, EPA decided to cap the Ashley River Approx. 2 ft. of sediment has already naturally deposited on the Barge Canal, but EPA will continue to evaluate the remedy for the Barge Canal (18) Sediments in the Barge Canal are "marginally toxic" (AA)	AA, 18
75	Calhoun Park/Aquarium Charleston, South Carolina	PAHs (former coal gas manufacturing plant)	Cooper River intertidal area; portion above water line at low tide; a portion continually submerged (19)	3 ft.	Clean sand	0.5 - 0.75 acre, estimated (19)	1996	Sand cap an interim measure, not a formal remedy Some scouring and mounding noted Very dynamic environment (19)	An aquarium was proposed to be built on the site. To avoid resuspension of PAHs during construction of 300 pilings, 3 ft. of clean sand was first laid (without geotextile) (18) Ecological risk assessment warrants further evaluation of formal remedy, although aquarium and National Park Service boat dock present physical constraints (19)	18, 19

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
76	Ward Cove Ketchikan, Alaska (thin-layer capping)	Ammonia, sulfide, and 4-methylphenol (AA) (generated in place from existing contamination)	Deep estuary, 1 mi. long & 0.5 mi wide; water depth at proposed capping areas: -10 to -110 ft. MLLW (AA) Very soft organic sediments; 80-acre AOC (X)	0.5 - 1 ft. 0.5 -0.75 ft. (X)	Clean sand from upland borrow source (10)	27 acres (10)	Feb. 2001	All sediment targeted for capping was covered by a thin-layer cap (10) The project went very smoothly; the AOC will be sampled every third July or until remedial objectives are achieved (1) Contractor had to verify that cap was properly placed (10) First monitoring event will take place in 2004 (chemical monitoring and bioassays will be conducted) (10) Lessons learned: (1) possible to place uniform cap on soft sediments with clamshell, (2) use a trial and error approach, (3) success when a close owner/contractor/regulator working relationship is in place to allow field modifications to meet clean-up objectives (X)	Originally, 21 acres were going to be covered by a thin cap and 5 ft. of mounding would be used on another 6 acres. The mound capping was not required since thin-layer caps could be supported by the sediment. Natural recovery was used where capping was infeasible, on 53 acres of the site (10) The thin layer cap provides a clean substrate for recolonization of the benthic community (10)	X, AA, 1, 10
77	Eagle River Flats Fort Richardson Army Base Anchorage, Alaska (pilot and follow-up study)	White phosphorus	Estuarine salt marsh next to former army firing range	3 to 4 inch layer (42)	Hydrated AquaBlok™	1.2 acre (1994 study)	1993 (pilot) 1994 (definitive study)	The AquaBlok™ immediately and significantly reduced the mortality of the duck test population (42) After one year, the treated area became revegetated and supported benthic life (42) After four years of exposure to extreme temperature and tidal influences, the treated area remains capped (42) Data collected to date indicates that AquaBlok™ shows promise for reducing waterfowl mortality from white phosphorous poisoning (43)	High waterfowl mortality was observed in early 1980s and traced to ingestion of white phosphorus-impacted sediments 1993 pilot study indicated that the system could reduce mortality of foraging waterfowl (43) Definitive study conducted in 1994 to evaluate the longevity of the system and measure its effects on waterfowl foraging behavior and mortality (43)	42, 43

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
78	Eagle River Flats Fort Richardson Army Base Anchorage, Alaska (full-scale)	White phosphorus	Estuarine salt marsh next to former army firing range						Preferred remediation method in Oct. 1998 ROD is to temporarily drain ponds to allow the pond sediments to dry out and allow white phosphorous to sublime and oxidize over a five year period, and then cap and fill area with AquaBlok™ where white phosphorous exposure remains a concern (44) AquaBlok™ would only be applied to small, deep portions of pond bottoms and would not significantly change overall pond depths or feeding habitat (44)	44
79	Nome, Alaska (CAD)		Harbor depth 20 ft.	4 ft.		1 acre			Small project similar to One Tree Island, in which contaminated surface layer was dug up and deposited in CAD cell. Approx. 35,000 cy of material placed in CAD cell	21
80	ALCOA (Point Comfort)/Lavaca Bay Site Point Comfort, Texas (thin layer capping)	Mercury	Tidal-estuarine; always underwater; water depth approx. 6-8 ft.	0.5 ft.	Hoping to find a new clay material; possible use of dredge spoils from federally maintained channel	50 acres estimated	ROD signed in Dec. 2001; construction may start in Dec. 2002		Remedy will include dredging, capping, and natural recovery Thin layer cap will be used to accelerate natural sedimentation Final design not complete Modeling of Category 5 hurricane indicated wet deposition, not exposure of deeper sediment	20
81	Homestead Air Force Base Outfall Canal (OU-11) Florida	PAHs, metals (2)	Canal approx. 40-50 ft. wide, 1 mile long and 10 ft. deep (2)	Possibly 2 ft. (2)	Possible: concrete-injected fabric, under geotextile mat, under clean sediment for plant growth (2)		In the Proposed Plan stage of Superfund (2)	The capping remedy has been approved by the Air Force, EPA, the State and Durham County (3)	Extensive storm water conveyance system of canals and swales transports the contaminants to the Canal Canal discharges storm water to Biscayne National Park, hence the urgency to address the sediments which appear to have damaged flora and fauna adjacent to the mouth of Outfall Canal (2)	2, 3
International Projects										

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
82	Rotterdam Harbor Netherlands (CAD)	Oils	Water depth 16 - 39 ft. (A)	2-3 ft.	Silt/Clay sediments	Est. minimum of 16.3 acres ⁽ⁱ⁾	1984	No available monitoring data	Groundwater pollution was a potential concern so site was lined with clay prior to sediment disposal and capping	A, F, FF
83	Amsterdam Netherlands (CAD)		Harbor basins; multiple CADs							KK
84	Ijmuiden (Averijhaven) Netherlands (CAD)		Tidal waters at entrance to the North Sea; 1 CAD							KK
85	Ijmuiden (Amerikahaven) Netherlands (CAD)		Non-tidal waters in main port area; 1 CAD							KK
86	Julianakanaal Netherlands (CAD)		Shipping channel						Deep pits in this channel were used for disposal of contaminated sediments from the River Maas	KK
87	Eitheim Bay Norway	Metals	Water depth up to 10 m		Geotextile and gabions	100,000 m ²				B
88	Kihama Inner Lake Japan (ISC)	Nutrients	3 sites	5 and 20 cm	Fine sand	3,700 m ²				B, C
89	Akanoi Bay Japan	Nutrients	3.9 ft. deep; 2 sites	20 cm	Fine sand	20,000 m ²				B, C
90	Hiroshima Bay Japan (ISC)		Water depth 70 ft.	5.3 ft.	Sand with shell		1983	No available data		A
91	Hiroshima Bay-Phase 1 Japan			50 cm	Sand	19,200 m ²	1979			B
92	Hiroshima Bay-Phase 2 Japan			30 cm	Sand	44,160 m ³	1980			B
93	Lake Biwa Japan			20 cm	Sand	22,000 m ²				B
94	Matsushima Bay Japan		Included dredging	30 cm	Sand	675 m ²				B

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
95	Minami-ko Japan			20 cm	Sand					C
96	Uranouchi Bay Japan		20-60 ft. deep	15-20 cm	Sand	17,400 m ²				B
97	Suonada Bay Japan		3-16 ft. deep	30-50 cm	Sand	15,900 m ²	1986-1987			B
98	Mikawa Bay Japan			40-100 cm	Sand	14,100 m ²				B
99	Tsuda Bay Japan		33-49 ft. deep	50 cm	Sand	418,000 m ²	1991-1993			B
100	Gokasho Bay Japan			20 cm	Sand	106,900 m ²				B
101	Uwajima Bay Japan			20 cm	Sand	46,800 m ²				B
102	Minimata Site Japan	Mercury		2.8 m	Geotextile sheets, two types of sand					B
103	Belgium (CAD)									T

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
104	East Sha Chau Contaminated Mud Pits Hong Kong (CAD)	Varied domestic and industrial pollutants, particularly metallic radicals (copper and chromium)		3 m minimum	<p>Pits I-III: Initial placement: ~1m sand, then ~2m clean capping mud</p> <p>One year later after pit infill settling: another 1-2m clean mud to bring cap back to level of surrounding seabed (55)</p> <p>Pit IV: 6m - 8m</p>	<p>Pits I-III: 570 acres⁽ⁱ⁾</p> <p>Pit IV: 500 acres⁽ⁱ⁾</p>	<p>Pits I-III: Dec. 1992 to Dec. 1997</p> <p>Pit IV: beginning in Dec. 1997</p>	<p>Independent reviews of results indicate absence of adverse and/or cumulative impacts, including risks to public health and ecology, and conclude that the disposal program has effectively isolated contaminants from the marine environment (55)</p> <p>The Environmental Impact Assessment study for CMP- IV determined that even though the pit would have larger surface area than previous CMPs, unacceptable environmental impacts would be unlikely as long as the maximum backfill level is limited to -14m PD. While a cap of 3m would be resistant to erosion under extreme storm events, there is space above the 3m cap for placement of about 5 m of additional clean material giving a final cap thickness of 6-8m (55)</p> <p>Usefulness of sand cap layer as part of CMP-IV was re-assessed and determined to be unnecessary because the mud cap layers will be placed by hydraulic methods and because costs don't appear to be warranted - earlier caps always revealed a distinct boundary between clean and contaminated mud (55)</p>	<p>Pits designed to maximize capacity while minimizing affected seabed area (55)</p> <p>Dec. 1992 to Dec. 1997: three pits used [CMP I, CMP IIa-d, and CMP IIIa-d] - these pits were dredged to base of the soft marine deposits, normally about 15 m below seabed (55)</p> <p>Design process evaluated effects of storm-induced shear stress during a seasonal typhoon for uncapped pits and completed cap; possibility of remobilization and loss of contaminated sediment was very low if filled depth was limited to 9m below sea level; geophysical surveys showed maximum natural scour to be ~1m, so 3m cap thickness used (55)</p> <p>Design cap also precludes burrowing organisms and anchors of shallow draft ships from breaching the cap (55)</p> <p>After Dec. 1997: CMP-IV used; these were exhausted marine sand borrow pits with estimated volume of 30 Mm³ expected (55)</p> <p>Capacity in the 4th pit will be exhausted in late 2007 (56) or 2003 at least (55)</p> <p>New CAD sites are being considered (BB, 56)</p> <p>22 Mm³ disposed of from Dec. 1992 to approx. Jan. 2001 (BB); 40 Mm³ expected by 2003 (55)</p>	T, BB, 55, 56
105	Lake Schwelvollert Trebnitz, Germany (ISC)	Phenols, ammonium, PAHs	Former open mining pit; 89 ft. deep max.; 9 hectares							DD, EE
106	Sweden (ISC)									T

	Sediment Project	Chemicals of Concern	Site Conditions	Design Thickness	Cap Material	Cap Area	Date Built	Performance	Comments	References
107	Lake Turingen Sweden (pilot ISC)	Mercury	197 acre lake, with maximum depth of 10 m	3 cm gel (Vattenresurs AB process)	Proprietary gel material ("artificial sediment")					52
108	Lake Turingen Sweden (full scale)	Mercury (from paper mill releases from 1946-1966)	197 acre lake, with maximum depth of 10 m (52)	Phase 1: cap - not specified Phase 2 cap: 5 cm (~2 in.) (52)	Phase 1 cap: geotextile and "suitable clean technological material" (53) Phase 2 cap: proprietary gel material ("artificial sediment") (52)	Phase 1 cap: not specified Phase 2 cap: 198 acres (52)	Phase 2 cap: to be completed in late autumn 2002 (52)		Phase 1: dredge sediments from the final reaches of River Turingen channel and section of Lake Turingen just outside of mouth of river; "clean" several shallow areas of the lake near river mouth; spoils to be redeposited underwater in the southern part of the lake; cap non-dredged areas of the lake near the river mouth (53) Phase 2: cap the "remaining accumulation in the lake bottoms with artificial gel" (53) Vattenresurs AB in Sweden patented the Phase 2 capping method (52) Raceway testing shows Phase 2 cap can manage current of 0.3 m/s (52)	52, 53
109	Sørfjorden Site Norway	Zinc, lead (54) (Concentrations of metals in sediment exceeded 10% zinc and 0.9% lead) (54)	Small bay near zinc factory; water depth < 33 ft.	30-60 cm (B) 30 cm sand over permeable membrane (54)	Nonwoven geomembrane and woven polyester geotextile and sand (B)	17.3 acres (54)		Capping was selected because of fears of gross contamination during dredging and lack of safe areas to deposit spoils; the industrial waste in bay is a very significant source of pollution; the contaminated material at the shoreline is exposed to tides and waves and is continually eroded and resuspended; during stormy weather the entire bay has been colored red (54)	The cap will be used in combination with a piled wall near shore (54) The sandy layer on top of the membrane is meant to protect the membrane, to adsorb some of the contaminants that are transported through the membrane, and to arrange for recolonization of organisms; the membrane will prevent bioturbation into the contaminated sediments and erosion of the sediments during stormy weather (54)	B, 54

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- 37: Personal communication with M. Lyons (LA Regional Water Quality Control Board)
- 38: Personal communication with R. Appey (Port of Los Angeles)
- 39: *Site Investigation Report Summary*, Hart Crowser, November 30, 2000, at www.deq.state.or.us/nwr/ri_Summary_final.pdf
- 40: News Release *DEQ Accepts Results of Port of Portland Study on Confined Disposal at Ross Island*, at www.deq.state.or.us/news/releases/129.htm
- 41: Letter from NOAA National Marine Fisheries Service to L. Evans, Corps of Engineers, Portland District, May 1, 2000 at www.nwr.noaa.gov/1publicat/2000/osb2000-0073.PDF
- 42: *AquaBlok™ Project*, by J. Hull, P.E., Hull & Associates, Inc., at www.epa.state.oh.us/dsw/rap/mau_profott3.pdf
- 43: *Evaluation of AquaBlok™ on Contaminated Sediment to Reduce Mortality of Foraging Waterfowl (1995)*, P. Pochop, J. Cummings, and C. Yoder, Abstract, at www.crrel.usace.army.mil/crf/bibliography/contracts/contract33.html
- 44: ROD Abstract (EPA/541/R-98/182, dated 9/30/98) for Operable Unit C at www.epa.gov/superfund/sites/rodsites/1001455.htm
- 45: *Summary of the Remediation Technologies Development Forum Sediments Remediation Action Team Meeting*, Cincinnati, Ohio, May 8, 2000, at www.rtdf.org/public/sediment/minutes/050800/may8rvd.htm
- 46: *Thea Foss Waterway Remediation: Design Status Report, Proceedings of the Western Dredging Association 20th Technical Conference and 32nd Annual Texas A&M Dredging Seminar*, June 25-28, 2000, Warwick, Rhode Island, R. Randall, Ed., CDS Report No. 372
- 47: Personal communication with J. Fields (U.S. Army Corps of Engineers)
- 48: Personal communication with N. Hamey (EPA Region 10)
- 49: Personal communication with P. Contreras (EPA Region 10)
- 50: Personal communication with P. Peterson-Lee (EPA Region 10)
- 51: Personal communication with L. Marshall (EPA Region 10)
- 52: Personal communication with S. Carlsson (Vattenresurs AB, Sweden)
- 53: "Lake Turingen remedial project: isolation of mercury-contaminated sediments", *LIFE - Environment in action: 56 new success stories for Europe's environment* at <http://europa.eu.int/comm/life/envir/successstories2001.PDF>
- 54: "A review of assessment and remediation strategies for hot spot sediments", *Hydrobiologia*, 235/236: 629-638, 1992., J. Skei, Norwegian Institute for Water Research
- 55: "Contaminated Mud in Hong Kong: A Case Study of Contained Seabed Disposal", *Proceedings of the 15th World Dredging Congress*, Volume 2, by J. Shaw, P. Whiteside and K. Ng, Las Vegas, Nevada, June 28-July 2, 1998, published by the World Organization of Dredging Associations, pp. 799-810.
- 56: *Strategic Assessment and Site Selection Study for Contaminated Mud Disposal*, Hong Kong Environment and Food Bureau, ACE-EIA Paper 4/2001, June 2001 at www.info.gov.hk/efb/board/eia/paper042001.html
- 57: Personal communication with J. Sutter (Oregon Department of Environmental Quality)
- 58: Personal communication with L. Priddy (EPA Region 10)
- 59: Personal communication with R. Santiago (Environment Canada)
- 60: Reynolds Metals Co ROD Abstract at www.epa.gov/superfund/sites/rodsites/0201465.htm
- 61: Faxed excerpts from *Site Investigation Report, Confined Dredge Facility, Ross Island Facility*, November 30, 2000, by Hart Crowser
- 62: *Appendix F to Consent Decree, Removal Action Work Plan for Upper 1/2 Mile Reach of Housatonic River, dated August 1999, and EPA approval letter dated August 5, 1999, October, 1999*, Blasland, Bouck & Lee, Inc., Syracuse, NY

C. Abbreviations:

AOC	Area of Concern
CAD	Confined Aquatic Disposal
CB/NT SS	Commencement Bay Nearshore/Tideflats Superfund Site
Cd	Cadmium
CDF	Confined Disposal Facility
CDM	Capping Dredged Material
cfs	Cubic Feet Per Second

CLIS	Central Long Island Sound
CMP	Contaminated Mud Pit
COC	Chemical of Concern
CSO	Combined Sewer Overflow
cy	Cubic Yards
DDT	Dichloro-diphenol-trichloroethane
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
HDPE	High Density Polyethylene
ISC	In-Situ Capping
MLW	Mean Low Water
MLLW	Mean Lower Low Water
NAPL	Non-Aqueous-Phase Liquid
NPL	National Priorities List
NUAD	Not Suitable for Unconfined Aquatic Disposal
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCDF	Polychlorinated Dibenzofuran
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
TBT	Tributyl Tin
TOC	Total Organic Carbon
UDM	Unacceptably Contaminated Dredged Material
USACE	United States Army Corps of Engineers
VOC	Volatile Organic Compound
WES	Waterways Experiment Station (USACE)

D. Footnotes:

- (a) Estimated by dividing the 0.6 m thickness into the 3100 m³ volume (Ref. E). According to J. Malek (Ref. 21), the initial cap area was approximately 0.7 acres. Because too much material was placed in too small a hole, too quickly, there was “slopping out”, so the actual cap feathered out to an area of approx. 1.3 acres.
- (b) Estimated from diagram provided at <http://www.wes.army.mil/el/dots/doer/pdf/trdoer1.pdf> (Ref. FF). B. Ross (EPA Region 9) believes that the calculated area could be correct for the LA project.
- (c) Estimated from diagram provided at http://www.wes.army.mil/el/dots/pdfs/drv1n2_3.pdf (Ref. P). Approx. 0.25 by 1.4 miles
- (d) Estimated from diagram provided at <http://www.epa.gov/tio/tsp/download/palermo-jointsession.pdf> (Ref. T)
- (e) Estimated by dividing the 1.5 m thickness (Ref. PP) into the volume of capping sediments, 65,000 cu m (Ref. RR)
- (f) Estimated based on mound diameter of 470 meters (Ref. UU)
- (g) Estimated based on mound diameter of 200 meters (Ref. SS)
- (h) Estimated based on diagram provided (Ref. 9) for the Mystic River CAD cells
- (i) Estimated from one (out of three) pit dimensions of 550 by 120 meters (Ref. EE)
- (j) Estimated based on diagram provided (Ref. 55) for the East Sha Chau mud pits

ATTACHMENT 3

CAD Projects Implemented in the 1980s and Early 1990s (from Palmerton 2003)¹

¹ Palmerton, D.L. 2003. Contained Aquatic Disposal (CAD) – A Review of Monitoring Programs. 2nd International Symposium on Contaminated Sediments. 218-228.

Table 6
CAD Case Study
Rotterdam Harbor (Phase I), Netherlands

Location :	Botlek Harbor, Rotterdam, The Netherlands
Description :	Construction of subaqueous disposal pits to dispose of contaminated dredge material.
Year of Construction :	1981-1982
Construction Technology :	Contaminated material dredged by two trailing suction hopper dredges and transported to Botlek Harbor. Placement material transported by scow. Material discharged by a modified suction dredge through a submerged diffuser.
Disposal Capacity :	1.8 million cy (only 1.1 million cy actually disposed)
Contaminant Types :	Chlorinated hydrocarbons, pesticides
Water Depth :	Approximately 95 feet
Monitoring :	
Baseline	None
Cell Construction	Turbidity measurements.
Dredging	Pre-dredging chemical testing of contaminated sediment cores. Turbidity measurements.
Placement	Turbidity measurements and sediment transport evaluation.
Cap	Unknown
Post Construction	Unknown
Lessons Learned :	<p>Experimental pilot testing preceded the work and provided valuable insight.</p> <p>Dredging temporarily raised the level of suspended sediment concentration in the project vicinity.</p> <p>There was no noticeable dispersion of contaminated sediment during discharge activities. However, maneuvering with large vessels lead to high peak values for turbidity in the project vicinity (i.e., 200 to 400 mg/L vs. Normal 40 mg/L).</p>
References :	Kleinbloesem et al 1983, d'Angremond et al 1984, Truitt 1987

Table 7
CAD Case Study
Rotterdam Harbor (Phase II), Netherlands

Location :	First Petroleum Harbor, Rotterdam, The Netherlands
Description :	Construction of subaqueous disposal pits to dispose of highly contaminated dredged material.
Year of Construction :	1983
Construction Technology :	Disposal pits dredged by a bucket ladder dredge. A suction head was mounted to a dismountable cutter suction dredge for contaminated sediment dredging. Placement by pipeline to submerged diffuser mounted on a suction pipe.
Disposal Capacity :	Approximately 600,000 cy was disposed
Contaminant Types :	Chlorinated hydrocarbons, pesticides
Water Depth :	Approximately 15 feet
Monitoring :	
Baseline	None
Cell Construction	Turbidity measurements.
Dredging	Pre-dredging chemical testing of contaminated sediment cores. Turbidity measurements.
Placement	Turbidity measurements and sediment transport evaluation. Groundwater measurements.
Cap	Unknown
Post Construction	Unknown
Lessons Learned :	
Advanced preparation and modeling may reduce the need for modifications during the project.	Monitoring and feedback are essential during dredging work in case dredging methods need to be modified mid-operation in order to meet sediment removal goals.
A de-gassing system was used during dredging to minimize turbidity from gas bubbles and problems with pumping (vacuum problems, reduced head).	Dredging and disposal of contaminated sediment can be performed without causing excessive turbidity.
References :	Kleinbloesem et al 1983, d'Angremond et al 1984, Truitt 1987

Table 2
CAD Case Study
Duwamish Waterway, WA

Location:	Lower Duwamish Waterway, Seattle, WA
Description:	Pilot study CAD to evaluate removal of shoaled contaminated sediment with disposal in a subaqueous depression (borrow pits) and capped with sand.
Year of Construction:	1984
Construction Technology:	Conventional clamshell dredge.
Disposal Capacity:	1100 cy contaminated fine, sandy, clayey silt plus 4000 cy cap material.
Contaminant Types:	Heavy metals, PCBs, Aldrin and others.
Water Depth:	Approx. 72 feet
Monitoring:	
Baseline	Bathymetry and tidal current monitoring. Background water quality including chemical, salinity, temperature, and density data. Sediment samples (surface and cores) analyzed for chemical constituents. Samples also analyzed from reference site. Side-scan sonar (SSS) used for monitoring.
Cell Construction	Not applicable.
Dredging	Water column samples for contaminants and total suspended solids (drawn from near-surface, mid-depth, and near-bottom). SSS monitoring. Continuous turbidity monitoring. Sediment samples for contaminants.
Placement	Water column samples for contaminants and total suspended solids (drawn from near-surface, mid-depth, and near-bottom). SSS monitoring. Continuous turbidity monitoring. Sediment samples for contaminants. Multi-tiered settlement plates.
Cap	Turbidity monitoring. SSS monitoring. Multi-tiered settlement plates. Visual confirmation by divers. Hydrographic survey.
Post Construction	SSS monitoring. Vibracore samples for chemical analysis. Water samples 1 meter above sediment upstream and downstream. Samples from borings at 2 weeks, 6 and 18 months, 5-year and 11-year. Predictive contaminant migration modeling. Data shows the cap has effectively isolated the contaminants.

Table 2 (continued)
CAD Case Study
Duwamish Waterway, WA

<p>Lessons Learned:</p> <p>Monitoring showed a bottom surge displaced some material outside the cell.</p> <p>Clay balls of contamination found in the capping material. Slight migration of contaminants into the cap.</p> <p>1995 study verified the applicability of the use of the RECOVERY model to assess long-term effectiveness of the cap.</p> <p>High level of acoustic background noise makes application of the SSS more difficult and time consuming.</p>	<p>SSS was successfully used to monitor disposal. The use of the SSS to determine limits of the cap was successful, but use of the sub bottom profiler was only marginally successful at determining cap thickness.</p> <p>Standard hydrographic survey depth sounder best tool for determining sediment thickness.</p> <p>Monitoring for 18 months and at the 11-year post-cap monitoring period showed no mixing of contaminated sediment with cap material and moderate to fair sediment quality for benthic in fauna.</p>
<p>References:</p>	<p>Truitt 1986, Truitt 1987, Sumeri 1996, Ruiz and Schroeder 2001</p>

Table 5
CAD Case Study
One Tree Island Marina, WA

Location :	Olympia, WA
Description :	Design of CAD to dispose of chemical constituent-containing sediments removed during deepening of the marina.
Year of Construction :	1987
Construction Technology :	Clamshell. Placement of material by bottom-dump barges.
Disposal Capacity :	Not available
Contaminant Types :	Lead, copper, zinc, cadmium, arsenic, and PAHs
Water Depth :	5 to 20 feet
Monitoring :	
Baseline	Sediment sampling and analysis for chemical constituents.
Cell Construction	Unknown
Dredging	Unknown
Placement	Unknown
Cap	Post construction sediment cores collected for chemistry.
Post Construction	No immediate post-cap chemical monitoring to establish baseline. Sediment cores collected for chemistry. Surface sediment samples and an off-site reference sample were collected to evaluate recolonization of benthos.
Lessons Learned :	Two years after CAD completion, sampling indicated a relatively diverse assemblage of benthic organisms. There was no evidence that the cap was being contaminated by the underlying sediments upon sampling the sediments two years after CAD completion.
References :	Sumeri 1996

Table 3
CAD Case Study
East Sha Chau, Hong Kong

Location:	East Sha Chau, Hong Kong
Description:	An overview of Hong Kong's contaminated mud management program, including the construction and operation and maintenance of their contaminated mud pits. Five pits contaminated mud pits (CMP) in use in 1994.
Year of Construction:	Beginning in 1992
Construction Technology:	Grab and trailer dredge
Disposal Capacity:	Approximately 13 million cy disposed from 1992 to 1996.
Contaminant Types:	Various contaminants including metals, organic pollutants (PCB, PAH) and sewage waste
Water Depth:	Approximately 65 feet
Monitoring:	
Baseline	Chemical testing of sediment various locations.
Cell Construction	Chirp seismic profiling.
Dredging	Suspended sediment surveys using satellite imagery (SPOT), high-level fixed-wing and lower-level helicopter color photography. Water sampling, turbidity meters, Acoustic Doppler Current Profilers (ADCP). Data shows sediment plumes decay rapidly with distance and not damaging the environment. Seabed ecology surveys using grab sampling and REMOTS seabed camera system.
Placement	ADCP surveys and turbidity meter measurements.
Cap	Unknown
Post Construction	Water, sediment and biota monitoring.

Table 3 (Continued)
CAD Case Study
East Sha Chau, Hong Kong

<p>Lessons Learned :</p> <p>Environmental and ecological monitoring have indicated that the operation of the mud pits appear to have no noticeable environmental impact.</p> <p>Sediment losses were negligible when disposal takes place during slack current conditions.</p> <p>On-site supervision and automatic self-monitoring devices that register barge position have eliminated the disposal of contaminated sediments outside of the designated area.</p>	<p>Sediment plumes from sand dredging decay rapidly with distance with visible remnants rarely beyond approximately 3000 feet from the dredging location.</p> <p>Chirp seismic profiling was used to monitor construction.</p> <p>An experimental disposal of clean sediment into empty seabed pits resulted in sediment losses of up to 10%. The deep water (approximately 65 feet) and high tidal currents were thought to be the cause of these losses.</p>
<p>References :</p>	<p>Brand et al 1994, Whiteside et al 1996, Shaw et al 1998</p>

ATTACHMENT 4

FOIA Request – July 28, 2010



Gary L. Gill-Austern

Direct Line: 617-439-2250

Fax: 617-310-9250

E-mail: ggill-austern@nutter.com

July 28, 2010
11478-26

BY E-MAIL & U.S. FIRST CLASS MAIL

David Dickerson
U.S. Environmental Protection Agency
5 Post Office Square
Suite 100 (OSRR07-4)
Boston, Massachusetts 02109-3912

**Re: New Bedford Harbor Superfund Site
Freedom of Information Act Request**

Dear Mr. Dickerson:

Pursuant to the Freedom of Information Act, 5 U.S.C. § 552 *et seq.* ("FOIA"), and on behalf of AVX Corporation, please provide a copy of:

- (1) any and all documents concerning a remedy review or alternatives analysis performed during the time period from August 2002 to the present by or on behalf of the United States Environmental Protection Agency ("EPA") with respect to the first operable unit at the New Bedford Harbor Superfund Site, including without limitation any and all documents generated before, leading to or used in support of the August 2005 memorandum entitled *Draft Internal Remedy Review and Alternatives Analysis, New Bedford Harbor Superfund Site* (which memorandum is Appendix C to the December 2006 *Technical Memorandum, Preliminary CAD Cell Volume Capacity Analysis* prepared by Apex Companies, LLC, Jacobs Engineering Group and the U.S. Army Corps of Engineers, New England District);
- (2) any and all documents concerning a remedy review or alternatives analysis performed during the time period from August 2002 to the present by or on behalf of EPA with respect to the first operable unit at the New Bedford Harbor Superfund Site, including without limitation any and all documents generated before, leading to or used in support of the *June 2010 DRAFT Fourth Explanation of Significant Differences for Use of a Lower Harbor CAD Cell*

NUTTER MCCLENNEN & FISH LLP • ATTORNEYS AT LAW

Seaport West • 155 Seaport Boulevard • Boston, Massachusetts 02210-2604 • 617-439-2000 • Fax: 617-310-9000

www.nutter.com

David Dickerson
U.S. Environmental Protection Agency
July 28, 2010
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("ESD #4") but not including those documents in the Administrative Record File for ESD #4; and

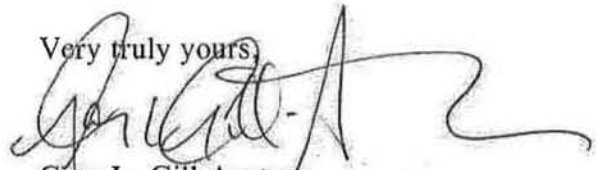
- (3) any and all other documents reflecting communications between or among EPA and any other party including without limitation (i) the U.S. Army Corps of Engineers, (ii) the Massachusetts Department of Environmental Protection, (iii) the New Bedford/Fairhaven Harbor Development Commission, (iv) the Massachusetts Coastal Zone Commission, (v) the Massachusetts Department of Transportation, (vi) the Massachusetts Department of Conservation and Recreation, (vii) the City of New Bedford, (viii) the Town of Fairhaven, or (ix) any consultant, contractor, subcontractor, entity, agency, office or department associated with any of those parties concerning a remedy review or alternatives analysis performed during the time period from August 2002 to the present by or on behalf of EPA with respect to the first operable unit at the New Bedford Harbor Superfund Site not otherwise provided in response to any of the above requests.

The word "documents" should be construed broadly to include documents or electronically-stored information, whether in draft, interim or final form, including without limitation correspondence, notices, notes, e-mails, studies, reports, memoranda, decision documents, standards, rules, guidelines, and policy statements. Documents may be stored in any medium from which information can be obtained either directly or, if necessary, after translation by the responding party into a reasonably usable form.

In the event any of the requested documents are not disclosable in their entirety, please release any separable material. With respect to those documents or portions thereof that are determined to be exempt from disclosure, please clearly identify the legal and factual grounds for withholding documents or portions of documents.

As provided under FOIA, please reply to this request within ten (10) working days. Thank you for your assistance.

Very truly yours,

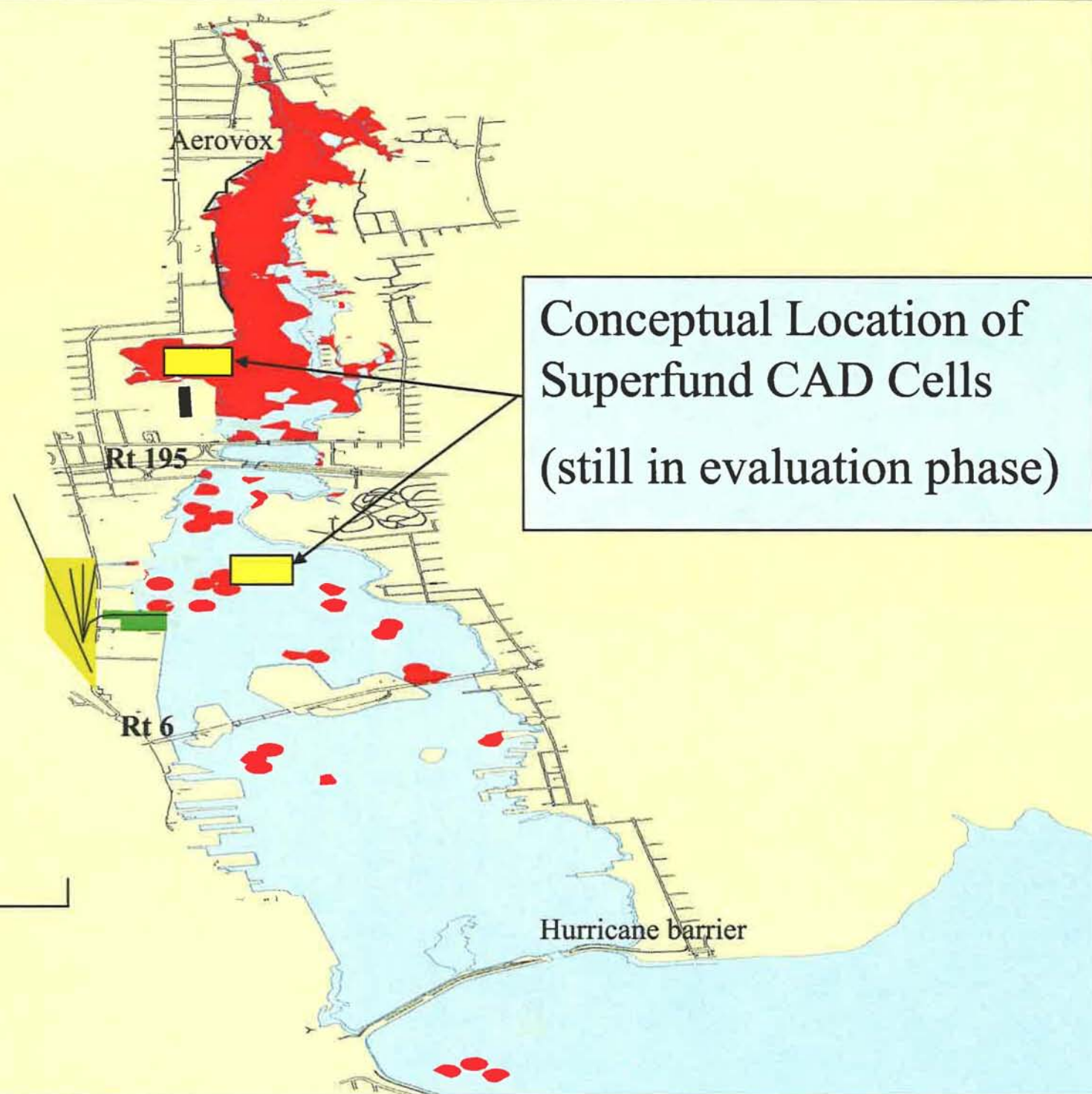


Gary L. Gill-Austern

cc (by e-mail only):
Cynthia E. Catri, Esq.
Elaine Stanley
Mary K. Ryan, Esq.

ATTACHMENT 5

Slide 54 from October 30, 2008
Public Presentation



RESUMES

ROBERT M. ENGLER, PH.D.

Senior Environmental Scientist (Geochemist -Wetlands Soils and Sediments)

OFFICE LOCATION: VICKSBURG, MS

REGISTRATION: 1969 - REGISTERED SOIL SCIENTIST (NATIONAL)

EDUCATION:

McNeese State University (1959-60)

U.S. Navy (1960-1963)

Louisiana State University, Baton Rouge (1964-72)

Major(s): PhD - Chemistry of flooded soils and sediments-1972

MS – Flooded Soil Microelement fertility-1969

BS - Soil Chemistry-1967

Minor(s): PhD - Radioisotope methodology for Flooded Soils/Sediments;

Microbiology

MS –Wetland Plant Nutrition (botany)

BS – Chemistry, Biology

EXPERIENCE:

Prior to joining Moffatt& Nichol as a Geochemist/Wetlands Soils and Sediments after completing a career at the USACE Waterways Experiment Station, Dr. Engler completed his Doctorate of Philosophy Studies majoring in the Geochemistry of Flooded Soils and Sediments and minoring in Radioisotope Methodology. For his Master's Degree studies, he majored in Microelement Soil Fertility and minored in Botany (Wetlands Plant Nutrition). His undergraduate studies majored in Soil Science and minored in Chemistry. His level of accomplishment with these studies was recognized by selection to membership in three honorary scientific societies – Alpha Zeta (1964), Gamma Sigma Delta (1969), and Sigma Xi (1980).

Dr. Engler, while employed by the USACE Waterways Experiment Station (WES), was a Geochemist-Wetlands Soils and Sediments, researcher, Program Manager, upper-management supervisor, technical lead of several national R&D Programs (i.e., Dredging, Wetlands, Sediments) and Senior Scientist/Technical Director of Civil Works R&D programs supporting the USACE Navigation Mission to include:

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Senior Environmental Scientist

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EXPERIENCE (continued):

- a. **The Dredged Material Research Program:** Environmental and engineering risk based research regarding navigation, regulatory, modeling, dredging technology, and monitoring and disposal management at a cost of \$50 million.
- b. **Wetlands Research Program:** Wetlands restoration, jurisdictional/regulatory, environmental management, and water quality in coastal and fresh water areas at a cost of \$30 million.
- c. **USACE Field Validation Program:** Field validation of regulatory assessment and testing protocols required for Clean Water and Ocean Dumping Acts for dredged material management in upland, wetland and aquatic disposal sites at a cost of \$6million.
- d. **Dredging Operations and Environmental Research Program:** Research to improve all aspects of the dredging process including engineering, environmental, restoration and regulatory. Research addresses contaminated and non-contaminated sediments, regulatory, beneficial uses, restoration, risk, all disposal alternatives, modeling and training at a cost of \$60 million.
- e. **Civil Works General Investigations R&D Program (\$30 million per year):** Technical Director of program supporting all components of the USACE Civil Works activities (e.g., Navigation, Construction, Regulatory, Recreation and Coastal Protection.

Technical contributions:

While at WES he has made notable technical contributions that have advanced the state-of-the-art in the geochemistry of dredged material, flooded soils, wetlands, sediments, toxic substances, and aquatic disposal, or domestic/international regulatory criteria. These accomplishments include:

- Development of a soil assessment technique for assessing the micronutrient (heavy metal) bioavailability to terrestrial and wetland plant systems (1969),
- Development of a technique for assessing the availability of various chemicals (macronutrients, micronutrient metals & toxic metals) in flooded and non-flooded soils and sediments (1972),
- Development (with Dr. John W. Keeley) of the "Elutriate Test" for assessing the mobility of contaminants from dredged material proposed for aquatic disposal. It is the most widely used test in the World for assessment of chemical mobility from dredged material (1975),
- Development of a practical sediment extraction procedure for evaluating the distribution, mobility, and bioavailability of contaminants in dredged material. The procedure maintained

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EXPERIENCE (continued):

the anaerobic integrity of the sediment sample resulting in a previously unattained realistic assessment procedure (1978).

- Development of procedures for assessing the effects of various levels of anaerobic intensity on the chemistry of hazardous and nonhazardous materials in sediments and flooded soils (1980).
- Development of ocean disposal guidelines for dredged material that were promulgated by the London Dumping Convention (LDC), an environmental/regulatory treaty that the U.S. and 61 other nations are signatory. These guidelines contain all aspects of testing, evaluation, and management of contaminated and noncontaminated dredged materials (sole author). Presented and successfully defended through appropriate U.S. review agencies and presented/successfully defended at the LDC (1987), and
- Development of a human health risk assessment for sediments and other bulky materials proposed for ocean disposal when there is a reason to believe the sediment has radionuclide contamination. Dr. Engler was the sediment expert on U.S. team at the International Atomic Energy Agency (IAEA) that developed the assessment protocol. It serves as a manual for regulators when making such an assessment. It is supported by a policy document for the application of radiological exclusion and exemption principles to sea disposal; this protocol is required for use by all nations (76) signatory to the London Convention. (2001)

Regulatory guidance documents: Other countries have used his work as a guideline or standard to develop similar regulations. International agencies have used his work as a starting point to develop their own regulatory guidelines, as have other countries. In addition, other researchers have conducted investigations that are extensions of or build upon these contributions to further the state-of-the-art in these areas. Examples of these occurrences include:

- Seventy six signatory nations to the London Dumping Convention are now using the Dredged Material Disposal guidelines that Dr. Engler was instrumental in developing, as part of their individual domestic ocean dumping regulations. The member nations' domestic R&D community modified the guidelines as appropriate to account for regional variables and policies (1987-present).
- The London Convention 1972 adopted a Dredged Material Disposal Guidelines in 1987 for its 72-nation membership. Dr. Engler was instrumental in revising these guidelines into the mandatory Dredge Material Assessment Framework (DMAF) that was unanimously adopted by the Convention in 1996. The DMAF allows for management of contaminated dredged material in ocean waters that was previously prohibited.
- As required by regulation, the Elutriate Test developed by Keeley and Engler is used by all USACE FOA's with a dredging mission. Several researchers have modified the approach for other disposal media (e.g., land disposal) (1975-present).

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Senior Environmental Scientist

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EXPERIENCE (continued):

- The USACE Ecological Evaluation of Proposed Discharge of Dredged or Fill Material into Navigable Waters (Interim Guidance for Implementation of Section 404(b)(1) of Public Law 92-500 (Federal Water Pollution Control Act Amendments of 1972), 1976. This is the first manual for the Corps' Regulatory and O&M Dredging Program that resulted in a nationally consistent approach in assessing dredged sediments. It is still the only inland manual in 1997.
- The Corps/EPA Ocean Dumping Implementation Manual, as required by regulation, has been modified by the EPA research and Regional Staff for use with drilling mud and sewage sludge disposal. The manual has withstood legal challenges in Federal Court and is the basis for revision of the ocean criteria and revised implementation manual (1981-present).
- The selective extraction techniques developed by Engler and Brannon for quantifying contaminants in soils and sediments are used and referenced by quantifying researchers in the United States, Canada, the Netherlands, the United Kingdom, Germany, Italy, and Japan (1978-present).
- The Corps/EPA manual for "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual - Inland Testing Manual." This manual replaced the Corps "Interim Guidance" in late 1997 and will be used for disposal in all U.S. waters inland of the baseline.
- Senior Environmental Scientist and Technical Director Civil Works R&D – 1995-2005. Directed the USACE navigation research that included dredging, contaminated sediments, wetlands, recreation, watershed environmental management, modeling, construction, restoration, remediation, risk, regulatory, environmental assessments, toxicology, and monitoring in fresh estuarine and marine waters.

Training activities: His expertise has been further recognized through invitations to be an instructor in many non-Government and Government-sponsored training courses. These include:

- Instructor, Texas A&M University Dredging Short Course, Environmental Impacts and Regulations, 1975-present,.
- Lecturer, Annual Dredging Technology Seminar, Old Dominion University, Norfolk-District-Sponsored, Norfolk VA, 1980-1985.
- Lecturer, Center for Environmental Dispute Resolution, Humboldt State University, Arcata, CA, 1993.
- Lecturer, Dredged Material Management Training Course – PROSPECT,
- Instructor, CE Committee on Water Quality Seminars, 1977 to present.
- Lecturer, CE Wetland Delineation, Assessment and Management Course on Chemistry of Flooded Soils,

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EXPERIENCE (continued):

- Lecturer, United Nations (UNEP and IMO sponsorship) Regional workshop on Hazardous Waste Management Policies and Strategies for East African Countries, Mauritius, Jun 1991; Cape town SA 1998; Ochoa Rios, JA 2000; Townsville Aust 2002.
- Lecturer, EPA Regional Seminar on Remediation of Contaminated Sediments, Jun 1991.
- Lecturer and Chair, EPA/CE Dredged Material Assessment and Management Regional Seminars, Pensacola, FL, 1991, Newport, RI, San Francisco, CA, 1992, Ann Arbor, MI, 1993, New Orleans, LA, 1994, Baltimore, MD, 1995, Portland, OR, 1995, Savannah, GA, 1997, Buffalo, NY, 1998, San Diego, CA, 2000, Baltimore, MD, 2001, San Francisco, CA, 2002, San Diego, CA, 2003, and Cleveland, OH, 2004.
- Lecturer, EPA Superfund/Sediment Remediation Workshop, 1992.
- Lecturer and Chair, CE Public Training Seminar on Dredged Material Disposal Alternative Selection, San Diego, CA, 1992.
- Lecturer, DOD Southeastern Region Environmental Management Training, Atlanta, GA, 1993.

Interagency Negotiations: Dr. Engler participated in numerous technical negotiations with the EPA concerning the development and publication of regulatory criteria and guidelines for the ecological evaluation of the discharge of dredged and fill material pursuant to Section 404 of Public Law 92-500 (Federal Water Pollution Control Act Amendments-FWPCA of 1972 and subsequent amending legislation) and Section 103 of Public Law 92-532 (Marine Protection, Research, and Sanctuaries Act-MPRSA of 1972 and subsequent amending legislation). Several negotiations were adversarial and were conducted before members of the Office of Management and Budget, 1974 to present.

Congressional Testimony:

Dr. Engler presented direct testimony to the U.S. Congress (House and Senate Committees) regarding contaminated sediments and dredging and dredged material management on at least 25 occasions over his career.

Moffatt & Nichol Project Experience:

Dr. Engler joined Moffatt & Nichol Jan 2006 and has worked on numerous environmental, dredging and contaminated sediments related projects. The projects ranged from harbor deepening to Super Fund sediment clean up activities. The following is a summary list.

AGL Marine Terminal Project: Environmental aspects of dredging. Advised and made recommendations on testing and management of contaminated dredged material for ocean dumping or alternatives.

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EXPERIENCE (continued):

Atlantic Sea Island-Safe Harbor: Permitting and ocean disposal. Advised and made recommendations for assessment at contaminated sediments pursuant to Clean Water and Ocean Dumping Act regulations, guidelines and criteria.

Bayshore Marina: Dredged Material permitting and testing. Described full Clean Water Act dredged material assessment and regulatory protocols in relation to dredging and upload disposal.

Chevron: Litigation Advisor: Technical Advisor regarding severe PAH sediment contamination and provided technical depositions on degree of contamination, risks and dredging and treatment technologies.

Golden Pass LNG Terminal: Dredged material management. Advised and made recommendations on ocean disposal, confined disposal and beneficial use for the dredged material.

Maintenance Dredging, Center Point terminal, Newark NJ: Completed all regulatory requirements (NJ and USACE) and documentation as well as dredging best management practices, treatment technologies for maintenance dredging of highly contaminated dredged material. Responsibilities also included the selection of competent dredging contractor.

Newark Bay Environmental Assessment (EA): Provided technical advice and deposition on controversial Newark Bay deepening dredging in a Superfund Study Area. Co-author of court ordered Environmental Assessment. Recommended best management practices for dredging, transport and disposal.

Newcastle, Australia: Hunter River PAH. Technical advisor and reviewer of all contractual plans and specifications for a major sediment remediation of severely PAH contaminated sediments. Recommended technical changes and alternatives to client. Provided international ocean disposal regulatory constraints and developed the regulatory compliance plan.

Honeywell Hackensack River CRCLA (Superfund Cleanup): Provided technical review on all aspects of the court ordered remedial plan for dredging and capping of chromium contaminated sediments. Also provided summary declaration for client submittal to the court.

South Brooklyn Marine Terminal: Dredged material permitting. Provided technical review, advice and recommendations for regulatory compliance and management and disposal alternatives.

Salton Sea restoration: Provided technical report on remediation of selenium contaminated lake sediments as part of a dredging and sediment reuse program.

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EXPERIENCE (continued):

Craney Island Expansion: Regulatory components of ocean disposal of 25-30 million cubic yards of clean sediment removed for construction.

Elizabeth River Restoration. Design a highly contaminated sediments remediation and restoration plan for the Republic location to include contaminated sediments management, dredging transport and treatment alternatives for the Elizabeth River restoration

General Electric: Hudson River Superfund Cleanup: Provided technical review, documentation and recommendations of the dredging, transport and disposal plans and specifications for the required Super Fund cleanup – Technical review of ongoing cleanup operations.

Passaic River Remediation/Restoration; Provided review, documentation and technical advice to the Potentially Responsible Parties and selection of most practical remediation technologies and current technical documentation supporting the EPA remediation plan.

Regional Sediment Management-Marketing Dredged Sediment for Beneficial Uses: Directed project for USACE HQ and ERDC to promote the beneficial uses of sediments dredged from the Great Lakes harbors by mapping sediment sources, quantifying sediment demands and by estimating sediment transportation infrastructure needs and cost components. Partners include USACE Buffalo, Detroit, and Chicago Districts, The Great Lakes Commission (GLC), other state and Federal agencies, and Moffatt & Nichol.

Jasper Ocean Terminal, Savannah USAEC District: Develop a supplement to the District Dredged Material Management Plan and Long term management Strategy to replace the lower confined disposal facility for future port construction and find capacity for one million cubic yards annually for a fifty year planning window.

Port of Morgan City: Conduct a sediment management study for the Atchafalaya River Bar Channel that has high sedimentation and fluid mud where navigation cannot be maintained by routine means. The proposed work focuses on determining if it is possible to: (1) keep sediment from consolidating in the channel by various agitation and water injection dredging means, and (2) using concepts of navigable depth and associated measurements, make the case to pilots that it is safe to navigate through the ABC mounds of unconsolidated fluid mud.

Professional Affiliations:

International Navigation Association (PIANC)

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EXPERIENCE (continued):

Chairman, PIANC International Environmental Commission, 1994-2007

Member, PIANC International Executive Committee, 1994-2007

U.S. Section - Vice-President 2007- 2011

Western Dredging Association (WEDA)

Board of Directors 1998-continuing

American Society of Civil Engineers

Member - Coastal, Oceans, Ports and Rivers Institute (COPRI)

Member – Waterways Committee

Chairman, Dredging Subcommittee, 1998-continuing

Publications (2000 – 2009):

Guidance on Assessment of Sediment Quality. Program of Global Investigations of Marine Pollution in the Marine Environment (GIPME). Pub. No. 439/00. International Maritime Organization (UN). London UK. 2000

Dredging the Facts. International Navigation Association (PIANC). Brussels. ISBX 90-75254-11-3. 1990(Updated in 2000)

Peddicord, R.; Brannon, J.; Bridges, T.; Cura, J.; Engler, R.; Lee, C.R.; Palermo, M.; Price, C.; Price, R.; Schroeder, P.; Simmers, J.; Tatem, H.; Wilson, J. 2000. Evaluation of Dredged Material Proposed for Placement in Upland Sites. Proceedings of the Western Dredging Association Twentieth Technical Conference and Thirty-Second Annual Texas A&M Seminar, 25-28 June 2000, Warwick, Rhode Island. R. E. Randall (ed.), Center for Dredging Studies, Texas A&M University, College Station, Texas. Pages 257-262. 2000.

A sea of Troubles, GESAMP (IMO, FAO, UNESCO, WMO, IAEA, UN, UNEP) Joint Group of Experts on the Scientific Aspects Marine Protection. Rep. Stud. GESAMP No. 70, 35pp.2001

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EXPERIENCE (continued):

Protecting the Oceans from Land-based Activities. GESAMP (IMO, FAO, UNESCO, WMO, IAEA, UN, UNEP) GESAMP Joint Group of Experts on the Scientific Aspects Marine Protection. Rep. Stud. GESAMP No. 71, 162 pp.2001.

An Introduction to Sediments. in Handbook on Sediment Quality. Water Environment Federation. Alexandria VA. ISBN I-57278-3. 2002.

Palermo, M.; Wilson, J.; Engler, R. 2002. USACE perspectives on sediment remediation. Proceedings of the Western Dredging Association Twenty-Second Technical Conference and Thirty-Fourth Texas A&M Dredging Seminar, 12-15 June 2002, Denver, Colorado. Randall, R.E., ed., Center for Dredging Studies Texas A&M University, Texas 77843-3136 Pages 235-250. 2002.

Palermo, M.; Engler, R. 2002. Thirty years of dredging research at the USACE Waterways Experiment Station. Proceedings of the Western Dredging Association Twenty-Second Technical Conference and Thirty-Fourth Texas A&M Dredging Seminar, 12-15 June 2002, Denver, Colorado. Randall, R.E., ed., Center for Dredging Studies Texas A&M University, Texas 77843-3136 Pages 79-92. 2002.

Palermo, M.; Peddicord, R.; Engler, R.; Wright, T.; Wilson, J.; Schroeder, P. . Tiered evaluations for confined disposal facility (CDF) contaminant pathways - upland testing manual. Proceedings of the Third Specialty Conference on Dredging and Dredged Material Disposal - Dredging '02 Key Technologies for Global Prosperity, 5-8 May 2002, Orlando, Florida. Stephen Garbaciak, Jr. (ed.), Published by the American Society of Civil Engineers (Available on CD from ASCE) 2002.

Determining the Suitability of Materials for Disposal at Sea under the London Convention 1972: A Radiological Assessment Procedure. International Atomic Energy Agency. Vienna,, Austria.ISBN 92-0-110803-1375. 2003.

J. A. Steevens, E. J. Antonio, R. Engler, L. Mathies. Assessment of Radionuclides in sediments Proposed for dredging. International Atomic Energy Agency (IAEA) Conference. Stockholm, Sweden. 2003

Litigation Technical Support (2006 – 2009):

2005. NRDC/Bay Keeper vs U.S. Army Corps of Engineers Contaminated Dredged Material Management, Newark Bay, NJ (NEPA violations). Prepared technical declaration and served as technical lead on preparation of a court ordered Environmental Assessment

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EXPERIENCE (continued):

regarding environmental dredging of highly contaminated dredged material as part of the Newark Bay navigation deepening.

2006. CRCLA (Superfund) remediation decision technical support. . Reviewed and recommended technical changes to the engineering and scientific Plans and Specifications for the court ordered aquatic sediment remediation (Hackensack River, NJ) with high level chromium contamination. Prepared declaration of my technical views for the court.

2007. Government of Ecuador vs Chevron. Cleanup of the Rio Blanco River regarding petroleum hydrocarbon contamination. Provided technical reviews as to the extent of contamination and the pros and cons of dredging for mass removal as a remediation technology. Submitted a declaration describing technical opinions.

Publications (Representative):

Dr. Engler has published more than 30 peer reviewed and more than 65 other articles on subjects covering geochemistry, dredged material management, radiochemistry, risk, regulations, and international perspectives. Notable examples include:

Engler, R.M. and W.H. Patrick, Jr., "Sulfate Reduction and Sulfide Oxidation in Flooded Soil as Affected by Chemical Oxidants." Soil Science Society of America Proceedings, Vol. 37, No. 5, 1973. (80%)

Engler, R.M. and W.H. Patrick, Jr., "Nitrate Removal from Floodwater Overlying Flooded Soils and Sediments." Journal of Environmental Quality, Vol 3, No. 4, 1974. (80%)

Engler, R.M. and W.H. Patrick, Jr., "Stability of Sulfides of Manganese, Iron, Zinc, Copper, Mercury in Flooded and Non-flooded Soil." Soil Science, Vol. 119, No. 3, 1975. (80%)

Joint Group of Experts on the Scientific Aspects Marine Protection, "The State of the Marine Environment, GESAMP (IMO, FAO, UNESCO, WMO, IAEA, UN, UNEP)." Blackwell Scientific Publications, USA, 3 Cambridge, Cambridge MA, 02142, 1990.

Engler, R.M., "Managing Dredged Materials". Oceanus, Vol. 33, No. 2, Summer 1990.

Engler, R. and L. Saunders, and T. Wright, "Environmental Effects of Aquatic Disposal of Dredged Material." Environmental Professional, 13:317-325, 1991. (70%).

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EXPERIENCE (continued):

Palermo, M.R. and R.M. Engler, and N.R. Francingues, "The United States Army Corps of Engineer Perspective on Environmental Dredging." Buffalo Environmental Law Journal, S.U.N.Y. at Buffalo School of Law, April 1993. (30%).

International Atomic Energy agency (IAEA) Group of Experts, "Application of Radiological Exclusion and Exemption Principles to Sea Disposal." IAEA-Technical Document-1068, Vienna Austria, 1999.

"Guidance on Assessment of Sediment Quality." Program of Global Investigations of Marine Pollution in the Marine Environment (GIPME). Pub. No. 439/00. International Maritime Organization (UN), London, UK, 2000.

Engler, R.M., "An Introduction to Sediments". In *Handbook on Sediment Quality*, Water Environment Federation. Alexandria VA. ISBN I-57278-3. 2002.

Engler, R. M. and D.J. Van den Bos, A. Macknight Kostianen, P. Mortensen, T. Holm-Karlsen, T. Vellinga, G.J. de Wolf, H. Bergmann, J.H. Sargent, V. Korolov, and G. Axelsson, "Disposal of Dredged Material at Sea." Permanent International Association of Navigational Congresses, Report of a Working Group of the Permanent Technical Committee II, Bull. No. 50; Brussels, Belgium; May 1986. (60%)

Engler, R.M., "Dredging - Technical and Policy Considerations." American Association of Ports Authorities - Symposium Washington, DC, Apr 1984.

Engler, R.M., "Availability and Plant Uptake of Heavy Metals from Contaminated Dredged Material Placed in Flooded and Upland Disposal Environment." Proc. of the Fifth U.S. - Japan Experts Meeting, New Orleans, LA, Nov 1979.

Engler, R.M., "Lead in the Marine Environment: Effects of Dredged Material Disposal." Proceedings of the Third Meeting of the U. S. /Dutch Memorandum of Understanding, Rotterdam, Netherlands, May 1983.

Engler, R.M., "Disposal of Dredged Material." Report to International Maritime Organization (IMO), Food and Agricultural Organization (FAO), World Health Organization (WHO), United Nations (UN), International Atomic Energy Agency (IAEA), United Nations Environmental Programs Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), Geneva, Switzerland. Aug 1987.

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EXPERIENCE (continued):

Engler, R.M., "Disposal of Dredged Material." Proc. of the International Maritime Organization (IMO), United Nations Environmental Programs (UNEP), International Oceanographic Commission (IOC) and, Government of Mexico Seminar on the Control of Waste Disposal at Sea, Mexico City, Mexico, Sep 1987.

Engler, R. M. "Legislative and Regulatory Components of a Waste Management Strategy." United Nations (UNEP, IMO) Regional Workshop on Hazardous Waste Management Policies and Strategies for East African Countries, Mauritius, Jun 1991.

Bridges, T. S. and D.W. Moore, R.M. Engler, T.H. DeWitt, and J.Q. Word, "What to Do with Bioaccumulation Data." SETAC News, Society of Environmentalist Toxicology and Chemistry, Pensacola, FL, Nov. 1997. (15%)

Engler, R. M., "The Effects of Application of Zinc on the Yield and Chemical Composition of Corn, Cotton, Rice and Soybeans Grown on Selected Soils in Louisiana." MS Thesis, Louisiana State University, May 1969.



Weldon S. Bosworth, Ph.D.

Senior Scientist

Areas of Expertise

Contaminated Sediment: Transport,
Fate and Management
Ecological Risk Assessment
Natural Resource Damage
Assessment
Marine and Aquatic Ecology
(Marine Benthic Ecology)
316a & 316b Evaluations

Years of Experience

With URS: 24 Years
With Other Firms: 13 Years

Education

PhD/Concentration in Marine
Ecology/1976/Oregon State
University
MS/Zoology/1969/University of
New Hampshire
BA/Zoology/1964/University of
New Hampshire

Registration/Certification

Professional Biologist, British
Columbia, # 1230

Overview

Dr. Bosworth is a Senior Scientist with URS. He has over 30 years of consulting experience in evaluating environmental impact and working with clients to develop strategies for site remediation. He has negotiated numerous scopes of work for environmental studies with state and federal regulatory agencies and has provided expert testimony on environmental impact at over a dozen regulatory hearings at state and federal levels as well as for cost recovery litigation. He has also made project presentations and moderated panels at various public and stakeholder meetings.

Dr. Bosworth has managed and led multidisciplinary teams evaluating potential environmental impact at several major marine, estuarine, and wetland sites and addressed a number of controversial site remedy issues. These efforts have included ecological risk assessments, natural resource damages assessments as well as evaluation of contaminated sediment management issues. This work also has lead management roles at six Superfund sites, four EPA Region V AOC sites and several contaminated sediment sites in Canada.

Dr. Bosworth was a member of and past Chair of the Scientific Advisory Committee of the U.S. EPA's Hazardous Substances Research Center South/Southwest, a consortium of universities led by Louisiana State University that conducts exploratory research in issues dealing with contaminated sediments and dredge materials.

Project Specific Experience

Xcel Energy - Ashland/NSP Superfund Site in Ashland, WI: Project Manager for risk assessment and sediment studies on Lake Superior. Sediment in area offshore from historical MGP plant is contaminated with elevated levels of PAHs. Responsibilities include managing remedial investigation of impacted sediments and ecological risk assessment, and supporting project team in issues dealing contaminated sediment management. Represented client in presentation to EPA National Contaminated Sediments Technical Advisory Group (CSTAG). Designed RI/FS Work Plan for aquatic ecology and sediment investigations to support Baseline Ecological Risk Assessment. Led treatability studies conducted as part of the Feasibility Study to evaluate the efficacy of sub-aqueous capping and confined disposal facility alternatives. Sediment quality triad, PAH forensics, soot and petrographic investigations were implemented during the RI. Coordinated with various stakeholder groups including two Native American tribes to ensure their concerns as well as National Resource Damages issues were addressed in RI studies. Provided Xcel Energy with comprehensive evaluation of potential NRD liabilities. As part of Feasibility Study activities, managed completion of three technical memoranda: Remedial Action Objectives, Alternatives Screening, Comparative Analysis of Alternatives. Managed three Treatability Studies including for, Air Emissions, Cap Flux and Multiphase Consolidation Testing.

Professional Affiliations

Past Chair and Member,
Scientific Advisory Committee
of the USEPA Hazardous
Substance Research
Center/South and Southwest,
1992-2002.

Member, Society of
Environmental Toxicology and
Chemistry, 1998-Present.

Member, Marine Studies
Curriculum Advisory
Committee, Southern Maine
Vocational Technical Institute,
1979-1980.

Invited member to NOAA
North and Mid-Atlantic Region
Conference on Marine Pollution
Studies, 1980.

Executive Board Member, New
England Estuarine Research
Society, 1976-1980.

Participated in OCEANLAB
(undersea laboratory) workshop
sponsored by New England
Marine Advisory Service, 1976.

AVX Corporation - Independent evaluation of U.S. EPA feasibility study at New Bedford Harbor Superfund Site: Principal Scientist and Project Manager to included assessments of environmental and transport issues related to Natural Resource Damages issues and CERCLA issues including site remediation. Developed alternative remedies to address potential adverse impacts of PCB and heavy metals contamination in the estuarine sediments of the harbor. Provided management of, and collaborated with a team of nationally recognized PCB experts who evaluated PCB fate and transport, sediment quality criteria, toxicology, ecological risk, epidemiology, etc. Forensic analysis using PCB congener relative abundance and distribution was conducted to distinguish sources. As an alternative to dredging of over one hundred acres of estuary a Remedial Action Plan was developed that involved alternative cleanup levels and in-situ subaqueous capping of approximately 50 acres of contaminated sediment in shallow Upper Estuary of New Bedford Harbor. In addition a mitigation plan for restoration of 13-acre salt marsh potentially affected by site remediation was developed. Evaluated apportionment of damages and remediation costs of various PRPs and third parties.

Natural Resource Damages Assessment, Army Creek Marsh, Delaware. Principal Scientist. Supporting Atlantic Richfield Company on negotiations regarding potential Natural Resource Damages liability associated with habitat injuries in freshwater tidal marsh along Delaware River.

Natural Resources Damages Assessment of the Southern California Bight: Principal Scientist. Provided litigation support and expert opinion on issues related to fate, transport and ecological effects of DDT and PCB associated with the sediment bed on the Palos Verdes Shelf.

Litigation support and expert testimony, Commencement Bay, Washington: Principal Scientist providing litigation support and expert testimony for Natural Resources Damages claims for confidential client.

CITGO Petroleum Corporation for a site in Sulfur, LA along the Calcasieu River Estuary: Principal Scientist. Independently evaluated the fate and transport of sediment-associated chemicals in Calcasieu Estuary. Monitored and critically reviewed all Calcasieu Estuary U.S.EPA RI/FS investigations as well preliminary Natural Resource Injury Evaluation prepared by NOAA.

Portland Harbor Superfund Site: Principal Consultant. Provided comments to Portland Harbor Trustees on NRD Damage Assessment Plan on behalf of Portland General Electric Company.

Baseline Ecological Risk Assessment for Hercules Chemical in Parlin, NJ: Principal Scientist and Project Manager. The objective of this study was to develop risk-based cleanup criteria for DDT in Brook 3 and the South River where DDT manufacturing by-products had historically been discharged. The assessment has involved evaluation of site-specific exposure pathways to receptors found in the area and estimating levels of DDT in sediment and surface water that would be protective of these receptors. A baseline ecological risk assessment currently was conducted

Specialized Training

40-Hour Occupational Safety and Health Administration (OSHA) HAZWOPER Training

Certified SCUBA diver for over 40 years. Have developed and implemented several scientific diving methodologies for collection of marine biological data.

Chronology

1994 – Present, URS Corporation (formerly Dames & Moore), Senior Consultant

1986 – 1994, Balsam Environmental Consultants, President and Senior Consultant

1972 – 1985, Normandeau Associates, Inc., President, Executive Vice President, Vice President of Operations, and Project Manager

and submitted to New Jersey DEP. Limited sediment remediation is now being planned. Based upon the results of this risk assessment sediment remediation was implemented. In 2009 supported litigation relating to potential NRDA liabilities.

Operable Unit 2 of Sullivan's Ledge Superfund Site in New Bedford, Massachusetts: Project Coordinator and Principal Scientist. Addressed Natural Resource Damages and Ecological Risk Assessment issues for Operable Unit 2: Middle Marsh. Evaluated potential effects of PCBs in wetland site. Provided litigation support for and participated in negotiations with other parties on allocation and cost issues. This includes presenting an alternative limited action strategy for leaving PCBs in place rather than destroying valuable wetland area. Negotiated Statement of Work, managed pre-design and remedial design studies. Managed all CERCLA processes after USEPA Feasibility Study including preparation of Remedial Design and implementation of Remedial Action measures which included restoration of six-acre forested wetland. Forested wetland constructed in 2001 and has since met five year Performance Criteria. Long term monitoring continues.

Tyco Suppression Systems-Ansul, Marinette, WI: Principal Consultant for RCRA site adjacent to Menominee River at the confluence with Lake Michigan. Prepared baseline ecological risk assessment for evaluation of effects of arsenic in sediments of Menominee River to invertebrate, fish and wildlife receptors. Identified different species of inorganic and methylated arsenic species to differentiate their respective effects. Work has included sediment characterization, sediment bioassays and comprehensive benthic community characterization. Supported Ansul negotiations for sediment cleanup goal for arsenic in Menominee River sediments. Supported Ansul negotiations for Administrative Order on Consent with Region V U.S. EPA. Natural recovery comprised a significant portion of the selected sediment remedy.

ConocoPhillips for sites in Weymouth, MA: Principal Scientist and Risk Assessor for risk assessment being conducted under Massachusetts Contingency Plan. As part of evaluation of sediment quality in Weymouth Neck Region, conducted PAH forensic analysis as well as soot and petrographic analysis. Results indicated predominantly low temperature pyrogenic sources of PAHs in the nearshore sediments and elevated levels of coal and slag in sediments. This meant much of the PAHs detected in the sediments were not bioavailable and intrusive remediation was not necessary. Prepared Supplemental Stage II Environmental Risk Characterization (under the Massachusetts Contingency Plan) to address potential risk from sediment contaminants.

Nexen (formerly Canadian Occidental Petroleum Ltd.) - Site in Squamish, BC. Principal Scientist and Project Manager. Completed human health and ecological risk assessment for assessing the potential effects of chlor-alkali and chlorate plant operations on Howe Sound and surrounding upland areas. Participated in consultancy process to ensure that stakeholder concerns were addressed in site investigations. Stakeholders included Squamish First Nations tribe. Risk assessment



evaluated the potential effects from several chemicals, including, mercury and chromium. Provided guidance to Nexen for management of contaminated sediments and ground water. Conducted sediment toxicity bioassays and benthic community characterization. Baseline ecological risk assessment included a probabilistic analysis of risk using Monte Carlo methodology. Provided expert testimony before BC Environmental Appeals Board on aspects of the project.

Various project alternatives for a 6-acre Portsmouth, New Hampshire port facility expansion on marine and wetland communities in the Piscataqua River: Project Manager for evaluating the environmental impact and permitting requirements. Developed extensive habitat mitigation plans, including for salt marsh and eel grass communities. Lead regulatory negotiations with NH Department of Environmental Services and U.S. Army Corps of Engineers. Successfully obtained NH state wetlands permit, U.S. Army Corps of Engineers Section 10 and 404 permits for dredging and ocean disposal, Coastal Zone Management Consistency, and Section 401 Water Quality Certification. Marine terminal was successfully permitted and construction was initiated in 1996.

New England District Army Corps of Engineers - Elizabeth Mine Superfund Site in South Stafford, VT: Principal Scientist and Ecological Risk Assessor. Responsibilities have included conduct of Screening Level Ecological Risk Assessment and a Baseline Ecological Risk Assessment. The Baseline Ecological Risk Assessment for mining-related metals in both aquatic and terrestrial habitats included the following site-specific analysis:

- AVS/SEM analyses;
- Bioassay testing;
- Benthic macroinvertebrate community analysis;
- Amphibian call survey;
- Multispectral aerial photography for canopy health evaluation; and
- Habitat and covertype characterization.

In addition, geochemical analysis of selenium in sediments was conducted to evaluate its bioavailability to the food chain. The results of the BERA were considered in remedial decision-making for the site.

Qualified and retained by CT DOT to provide expert testimony: Principal Scientist and Expert on PCB fate and effects. Addressed the potential effects of bridge construction on mobilization and transport of sediment-associated PCBs.

Union Carbide (now Dow Chemical) for site in Belleville, Ontario: Senior Consultant and Project Manager. Evaluated alternatives for site remediation and conducted a Ecological Risk Assessment of potential impacts of PCB and other constituents in a Lake Ontario wetland. Evaluated comparative impacts of excavation versus monitored natural recovery of PCB wetlands. This Risk Assessment was conducted



following Ontario Provincial guidelines. A natural recovery strategy for the wetlands was approved by the Ontario Ministry of the Environment.

Dow Chemical Canada, Inc. for site in Sarnia, Ontario: Principal Scientist and Project Manager. Worked with Dow to help develop strategy for addressing impacted sediments (Hg, HCB, HCB, PCB, OCS) in St. Clair River along Dow waterfront. URS developed a workplan for sampling sediments to acquire data to support an evaluation of remedial alternatives. URS developed estimates of contaminant mass for given areas using GIS, and proceeded to evaluate and cost several potential remedial options for the area most severely impacted immediately adjacent to the Site. URS worked with Dow in a consultancy process with other Stakeholders to narrow down the range of remedial options and after negotiations with Ontario Ministry of the Environment and Environment Canada a remedial plan which included hydraulic dredging of sediments with mercury in excess of 10 µg/g and subsequent capping with clean sediment.

The project was conducted in four phases. URS assisted Dow in management of the Pilot dredging project and Phase I dredging which were successfully completed in 2003.

Goodrich Corporation for RCRA investigation in Marietta, OH: Principal Consultant. Assisted in developing successful strategy to support a natural recovery remedy for DDT-impacted sediments in Duck Creek, a tributary of the Ohio River.

Domtar, Inc., for evaluation of sediment contamination by metals at Vancouver Shipyard, Vancouver, British Columbia: Principal Consultant. Work consisted of critical review of historical reports and development of an expert opinion on implications of contaminant characteristics to Responsible Parties activities.

GE Medford, MA site: Principal Consultant and Risk Assessor. Responsibilities have included preparation of a Stage II Environmental Risk Characterization (under the Massachusetts Contingency Plan) addressing PCBs in the sediments of an aquatic area contiguous to the Mystic River.

Bethlehem Steel Corporation, Lackawanna, NY: Senior consultant. Developed a Tier 2 ecological risk assessment of former coke and steel manufacturing operations site located on Lake Erie. Considered potential impacts on both terrestrial and aquatic receptors from various constituents of potential concern, including PAHs, resulting from those operations.

Dow Chemical Canada, Inc. for site in Sarnia, Ontario: Principal Scientist and Project Manager. Worked with Ontario MOE and Environment Canada on behalf of Dow to develop risk assessment guidance for the management of contaminated sediments in other areas of the St. Clair River.

OCS test site, George's Bank, Baltimore Canyon, Georgia Embayment. Officer-in-Charge of physical and biological studies prior to leasing of offshore areas for exploratory drilling.



Alcan Rolled Products Company in Oswego, New York: Senior Consultant for an ecological risk assessment for evaluating potential effects of PCB and pesticides in wetlands and ponds. Involved evaluating potential for natural attenuation through burial and biodegradation. PCB congener vertical distribution and toxicity equivalency is being addressed.

BCMWLAP contract managed by Golder Associates: Principal Scientist and Senior Peer Reviewer for screening ecological risk assessment evaluating the potential impacts from Britannia Mine on Howe Sound, British Columbia intertidal and subtidal ecosystems.

Union Carbide for site in Ponce, Puerto Rico: Principal Scientist and Project Manager. Work involved developing work plan for sampling PAH-impacted sediments in former discharge. A management-level ecological risk assessment was also conducted to develop alternative action levels for cleanup of PAHs in order to guide remedial decisions.

General Electric - Investigations at GE Schenectady Plant: Senior Consultant and Risk Assessor to Responsibilities have included development of a proposal for a habitat enhancement and natural attenuation plan in lieu of RCRA cap for 200 acre landfill on site. This work has also included the preparation of a screening ecological risk assessment.

U.S. Army Corps of Engineers - Lake Ontario shoreline protection study. Project Manager.

U.S. Army Corps of Engineers - Several projects at various New England harbors: Officer-in-Charge. Provided information on the environmental impacts of dredging and spoil disposal.

McKin site in Gary, Maine: Project Manager for Limited Ecological Risk Assessment. This project evaluated the potential risk of trichloroethylene and 1,1,1-trichloroethane in ground water to aquatic receptors in a nearby stream. An instream benthic macroinvertebrate evaluation was also conducted following Maine Department of Environmental Protection protocols.

Method 2 Modification to Massachusetts Contingency Plan Standards: Project Manager. This project involved the use of a ground water transport model to predict concentrations of cyanide in ground water and extrapolate potential effects to downstream surface water receptors.

Portsmouth Naval Shipyard in Kittery, Maine: Officer-in-Charge of development of a candidate environmental impact study for a proposed dredging program. Involved assessing dredging impacts as well as evaluating and selecting both offshore and upland spoil disposal sites.

Publications/Presentations

Palermo, M.R. and W.S. Bosworth. 2008. Use of Confined Disposal Facilities for Sediment Remediation. Presented at WEDA XXVII 39th Annual Dredging Seminar

Huls, H., W. Bosworth and Jerry Winslow. 2008. Engineering Test Evaluation for Capping of Manufactured Gas Plant and Wood Milling Contaminated Sediments in Ashland Harbor, WI. 6th International Conference on Remediation of Chlorinated and Recalcitrant Compounds.

Bosworth, W., G. Long, D. Lauren and J. Winslow. 2007. Sediment Quality Triad Study for the Ashland/ Northern States Power Lakefront Superfund Site. Presented at the Fourth International Conference on Remediation of Contaminated Sediments in Savannah Georgia in January 2007.

Reed, C., A. Whitworth and W. Bosworth. 2007. Sediment Stability Assessment for the Ashland/Northern States Power Lakefront Superfund Site. Presented at the Fourth International Conference on Remediation of Contaminated Sediments in Savannah Georgia in January 2007.

Turner, R. and Bosworth, W.S. 2006. Remediation of a Mercury Cell Chlor-Alkali Plant Site at Squamish, BC, Canada. Presented at Mercury 2006 Conference in Madison WI, August 2006.

Bosworth, W.S. and Turner, R.R. 2001. The Fate and Transport of Mercury in a Canadian Fjord. Presented at SETAC 2001.

Turner, R.R. and Bosworth, W.S. 2001. Identification and Evaluation of Potential Groundwater Transport Pathways from Former Chlor-alkali Plant into a Fjord System. Presented at SETAC 2001.

Bosworth, W.S., Thibodeaux, L.J., Reible D.D. 1999. In Situ Capping of Contaminated Bed Sediments. A workshop was conducted that brought together selected members of the research, regulatory and consulting engineering communities on a national level. The purpose of this workshop was to develop a common perspective of the state of the practice, identify and discuss technical issues that need solution and develop an action plan to address these issues. The results of this workshop were published and incorporated into an Internet site for the U.S. EPA Hazardous Substances Research Center/South and Southwest.

Bosworth, W. S. and S. A. Sundstrom. 1995. How Much Do We Need to Dredge? Strategies for Decision Making When Dredging Contaminated Sediments. Presented at the Fourteenth World Dredging Congress. November 1995. Amsterdam, The Netherlands.

Short, F. T., R. Davis, D. M. Burdick, D. McHugh and W. S. Bosworth 1995. Restoration and Creation of Eelgrass, Salt Marsh and Mudflat Habitat in the Piscataqua River, New Hampshire. Presented at the autumn 1995 meeting of the Estuarine Research Federation Conference.

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Bosworth, W. S., 1976. The Biology of the Genus Eohaustorius (Amphipoda: Haustoridae) on the Oregon Coast. Ph.D. Dissertation. Oregon State University. 200 pp.

Bosworth, W. S., 1973. Three New Species of Eohaustorius (Amphipoda: Gammaridea) from the Oregon Coast. Crustaceana. 25(7):253-260.

Authored and/or contributed to hundreds of technical reports on various aspects of marine and aquatic communities.



Gary Greenberg, PE

Vice President

Areas of Expertise

Delay analysis, productivity analysis, change order evaluation

Years of Experience

With URS: 2 Year

With Other Firms: 39 Years

Education

BS, Civil Engineering with honors, Clarkson University, Potsdam, NY

Chi Epsilon – National CE honor fraternity, Clarkson University, Potsdam, NY

Professional Engineer License– New York

Affiliations

American Society of Civil Engineers

AACE International (past president of Tampa Bay Chapter)

National Society of Professional Engineers

Construction Management Association of America

American Institute of Constructors

Massachusetts Building Congress

Construction Industries of Massachusetts

Construction Association of South Florida

Summary

Gary Greenberg has over 40 years of combined experience in construction claims consulting services and construction management. Mr. Greenberg has been involved in preparation, analysis, and resolution of complex construction claims related to airports, commercial buildings, condominium projects, hotels, power plants, transportation facilities, educational facilities, process plants, sports facilities, and healthcare projects. He has been named as the testifying expert in Federal, State and arbitration proceedings for the areas of forensic CPM schedule analysis, lost labor productivity, and the associated financial damages. Mr. Greenberg has successfully resolved construction disputes in the negotiation and mediation stages by presenting comprehensive analyses of issues and positions. Mr. Greenberg has extensive experience in representing all parties to the construction and design process and has defended design and construction management professionals on behalf of professional liability carriers.

Project Specific Experience

Liberty Place II, Philadelphia, PA

On behalf of the structural steel fabricator and erector for the tower, shopping mall and portions of the hotel, Mr. Greenberg prepared a comprehensive delay and lost productivity claim that was ultimately settled at mediation. Mr. Greenberg addressed design changes and the lack of coordination of the various trade contractors by the CM.

Miami Beach Convention Center, Miami Beach, FL

Mr. Greenberg represented the City of Miami Beach in the defense of a construction claim related to a major expansion of the Convention Center. The claim alleged structural steel design errors and was brought by the construction manager and its structural steel fabricator and erector. Mr. Greenberg evaluated the claims and the effects of the steel delay on the schedule of the follow-on work of the project.

World Trade Center Reconstruction, New York, NY

Mr. Greenberg leads a team of professionals that is responsible for the review and analysis of all major construction claims submitted by contractors working on the project. Working closely with the Port Authority of New York and New Jersey Mr. Greenberg's team has been called upon to review claims related to differing site conditions, delays, lost labor productivity, terminations for convenience, and disputed change orders.

Sheraton Hotel and Conference Center, Houston, TX

On behalf of the general contractor Mr. Greenberg prepared a comprehensive claim document that cataloged the delays and extra costs



incurred. Mr. Greenberg performed a CPM schedule analysis to identify the causes of delays and to demonstrate the impact of design and scope changes. Delay issues included problems with the owner required curtain wall system and the late revisions to guest room configurations. The case was settled through negotiation.

Burger King World Headquarters, South Miami, FL

Mr. Greenberg successfully defended a construction claim from the construction manager that built Burger King's World Headquarters in South Miami, FL. The construction manager's claim addressed construction delays and an increase in the scope of work.

Logan Airport, Boston, MA

On behalf of the general contractor for the construction of the Terminal B and C connectors and moving walkways, Mr. Greenberg prepared a comprehensive construction claim. The claim addressed delay issues such as unanticipated subsurface utilities, limited access, increased security requirements following the September 11th attacks (the project was in construction at the time), interfaces with other owner projects and design changes.

Broward County Environmental Services Complex

As an outside consultant for Broward County Mr. Greenberg analyzed and defended the claim from the general contractor for the project. The project consisted of a series of buildings that houses the administrative and support services for the County. The claim centered on delay caused by an apparent structural design error as well as other issues.

South Nassau Communities Hospital, Oceanside, NY

Mr. Greenberg analyzed construction claims asserted by the construction manager and ten of its subcontractors for the expansion and renovation of this major community hospital located in Oceanside, New York. Mr. Greenberg participated in all forty-five arbitration hearings and provided expert testimony related to schedule delay analysis.

JFK International Airport Cogeneration Project, New York, NY

During the construction of this modification to the central utilities plant that included the installation of heat recovery steam generators, Mr. Greenberg assisted the electrical subcontractor F. Garofala Electric with scheduling and delay issues. Mr. Greenberg worked with the construction manager's scheduling personnel to mitigate delays and to protect his client's interests during acceleration of the work.

The Grand Hotel, Steamboat Springs, Colorado

Mr. Greenberg was retained by the owner of this luxury resort hotel to investigate the causes of delays and the extensive amount of change orders submitted by the general contractor. Delays that threatened to prevent opening the hotel for ski season included incomplete and faulty design and contractor work quality problems.

**Boston Convention & Exhibition Center, Boston, MA**

Mr. Greenberg defended a claim from the foundation contractor for the new BCEC on behalf of the Authority. The contractor's claim related to differing subsurface conditions and unpaid extra work.

Miami Dade School Board, Miami, FL

Mr. Greenberg worked with outside counsel for the School Board on a high school expansion and renovation project that experienced delays, the resignation of the architect of record, and unanticipated change order costs. Mr. Greenberg and his team helped select the replacement architect and provide project administration to see the project through to completion without litigation.

Florida Department of Transportation v Southern Bell

Mr. Greenberg analyzed utility relocation claims against the telephone utility that were passed through by the DOT based upon bridge and highway contractors' claims against the DOT. Mr. Greenberg worked with counsel for the utility to prepare for depositions and participated in document discovery.

Palm Beach International Airport

Mr. Greenberg defended the general consultant for the new Palm Beach Airport from the claims of the general contractor. The general consultant had the responsibility for all design aspects of the new terminal and related buildings. Mr. Greenberg participated in mediation that encompassed the County (the owner), the contractors, the design team and the construction manager.

Columbia Presbyterian Hospital, Manhattan, NY

On behalf of the drywall, plastering, and acoustical ceiling subcontractor for a major addition to this medical facility located on the Upper West Side of Manhattan, Mr. Greenberg prepared an analysis of lost labor productivity that resulted from acceleration and poor construction coordination. The claim was asserted against the general contractor and was settled through negotiations.

Dallas-Fort Worth International Airport, Dallas, TX

On behalf of the Mechanical Contractor for the new and expanded \$200 million Central Utility Plant project and utility distribution system, Mr. Greenberg prepared delay and lost labor productivity claims against the construction manager. The schedule analysis to prove the delay claim utilized a classic CPM windows analysis that demonstrated the effects of numerous changes. The claim was settled at mediation.

The Rainbow Room

Mr. Greenberg prepared a request for equitable adjustment on behalf of the Electrical Subcontractor for the renovation of this three-story dining and entertainment complex at the top of Rockefeller Center. The value of the electrical subcontract increased five-fold due to scope changes and



acceleration. The claim addressed the enormous loss of labor productivity due to the acceleration and resultant working conditions.

St. Mary's Medical Center, Nashville, TN

Representing the General Contractor for the construction of a new patient tower that included CCU, ICU, a new radiology department, and emergency room facilities located in Nashville, TN, Mr. Greenberg prepared a request for equitable adjustment to the contract. The claim sought damages for delays resulting from design errors and omissions and from late completion of preceding work. Mr. Greenberg participated in settlement negotiations that resolved the claim.

United Nations Headquarters

Mr. Greenberg analyzed cost increases related to additional design services for the construction of an underground printing plant and document storage facility under the North Lawn of the UN Headquarters. The project included the expansion of the Delegates' Lounge and an addition to the cafeteria and kitchen facilities. Mr. Greenberg worked with in-house architects and accountants to analyze design fees.

Veterans Administration Medical Centers

As the lead consultant on an on-call contract to defend construction contract claims against the VA, Mr. Greenberg successfully defended various claims. Sites included Tampa, Florida, Biloxi and Gulfport, Mississippi, and other southeastern facilities. Mr. Greenberg worked with VA legal counsel in Washington, DC and local contracting officers.

Miami International Airport, Miami, FL

Mr. Greenberg represented the surety for a defaulted electrical subcontractor to oversee completion of the electrical work for a new international concourse. At the completion of the work Mr. Greenberg prepared and settled a delay with the general contractor.

Novotel Hotel, New York, NY

On behalf of the Owner of this high rise hotel that was built in the Times Square area of New York City on top of an existing four-story building, Mr. Greenberg analyzed and defended a claim from the structural steel fabricator and erector. The contractor's claim alleged scope changes, access restrictions, and changed working conditions. The case was settled shortly after the start of arbitration hearings.

New York University Medical Center, New York, NY

Mr. Greenberg prepared a comprehensive construction contract claim on behalf of the prime electrical contractor for this 25-story medical facility. The electrical contractor experienced delays and interruptions to its work resulting from poor coordination of multiple prime contracts, owner changes, lack of access, and interface problems with proprietary security and fire alarm systems.



Steubenville Joint Justice Facility

This project consisted of a new county jail, sheriff's department headquarters, prosecutor's office, juvenile court, and juvenile detention facility. Mr. Greenberg was part of the team that defended the performance of the design professional who designed and administered the construction of the complex. Mr. Greenberg's portion of the expert report addressed the performance of the duties and responsibilities during construction administration.

General Motors Assembly Plant

Mr. Greenberg defended a claim from the Mechanical Contractor for the construction of this new facility. The contractor's claim addressed delays, design changes, and lost labor productivity. The defense included the preparation of detailed piping charts to track the contractor's performance of original scope and extra work over time and to measure the contractor's productivity.

United Airlines Terminal – O'Hare International Airport

During the construction of the new landside and airside terminals Mr. Greenberg prepared claims for the electrical, mechanical, and underground fuel system subcontractors for the project. The claims addressed delay analyses and cost analyses related to acceleration, lack of access, and scope changes.

Drew University, Madison, NJ

Prepared a request for equitable adjustment for the contractor for concrete and masonry work at the new library at Drew University. The claim addressed the issues of lack of access and structural design changes. The request included a schedule analysis and the calculation of the contractor's damages.

University of Florida, Gainesville, FL

Defended a construction claim for the Office of the State Attorney General that was brought by the general contractor for the construction of a new housing complex at the University of Florida. The contractor's claim alleged that design deficiencies and excessive owner changes delayed its work. Services included the evaluation of the effect of change orders on the contractor's schedule and a review of the standard of care exercised by the architect of record.

Dormitory Authority State of New York, Queens, NY

On behalf of DASNY Mr. Greenberg leads a team of professionals that has analyzed change orders to determine in order to identify causes such as design errors, field conditions, contractor requests, program changes, etc. The assignment also includes the analysis of two delay claims and a structural design claim.

Central Connecticut State University, New Britain, CT

Prepared a claim against the University for the general contractor for a



new residence hall and assisted in the defense of a claim from the electrical subcontractor for the same project. The project experienced delays due to differing subsurface conditions and structural design deficiencies related to the load-bearing masonry system. Prepared the schedule analysis and damage calculations for the contractor.

Hillsborough County Public Schools, Tampa, FL

On behalf of the owner prepared the defense of a claim from the general contractor for the conversion of a retail department store into an adult education center. The contractor's claim alleged delays due to design changes and late approval of shop drawings. The defense included the evaluation of the effects of change orders to the contractor's schedule and the calculation of an equitable value for the time-related delay costs.

New Jersey Institute of Technology, Newark, NJ

Prepared a construction claim for the general contractor performing the renovation and remodeling of one of NJIT's laboratory and classroom buildings. During demolition problems arose concerning the structural stability of the building's exterior masonry system and related to proposed changes to the structural concrete floor systems. Prepared a report that analyzed the effects of the structural problems on the contractor's schedule identifying the causes of delay and assigning responsibility for delays.

Expert Testimony Assignments

GB Hotel Partners, Ltd v. Odebrecht Construction, Inc., Key Biscayne, FL (Ritz Carlton Hotel and Towers)

Mr. Greenberg was retained by counsel for the general contractor who constructed this hotel and condominium project to serve as scheduling and damages expert. In the ensuing arbitration case captioned above Mr. Greenberg provided expert testimony for the respondent. His testimony presented the forensic schedule that addressed the causes of critical delays to the project and unpaid extra work. The critical delays were driven by design and program changes to the project. Mr. Greenberg's client Odebrecht, the General Contractor prevailed in the arbitration.

Westinghouse Corporation v. New York City Transit Authority, New York, NY

This case related to a signal modernization and renovation contract for a portion of the New York City Subway System from lower Manhattan to Brooklyn. Mr. Greenberg's client, Jackson Electric Company was the installation subcontractor for the Plaintiff. The case was a jury trial in Brooklyn Supreme Court and Gary Greenberg's expert testimony related to schedule delays and losses of labor productivity. The jury and trial court's decision overcame New York City's no-damage-for delay provision.

Lumus Construction, Inc. v. U.W. Marx Construction Company, Hyde Park, NY



Gary Greenberg was been named as the expert for the Plaintiff in this case that was brought in the United States District Court for the Southern District of New York. Mr. Greenberg prepared an expert report that addressed schedule delays and lost labor productivity and provided deposition testimony related to his analysis. The parties opted for arbitration in lieu of trial and were able to settle the case prior to the start of hearing. Mr. Greenberg presented the contractor's position at mediation. The case involved the construction of the Visitor Center and Library Renovation at the FDR Presidential Library in Hyde Park, NY.

TREVIICOS South, Inc. v. GLF Construction Corporation, Wilmington, NC

In this recently completed arbitration proceeding Gary Greenberg testified for the claimant regarding the construction of a bridge over the Cape Fear River outside of Wilmington, NC. Mr. Greenberg's testimony focused on delay issues related to the installation of the foundation system.

Mid-Atlantic Constructors, Inc. v. Stone & Webster Construction, Inc., Philadelphia, PA

Gary Greenberg was named as the expert for the Defendant in this case that was filed in the United States District Court for the Eastern District of Pennsylvania. The case related to the construction of a cogeneration plant on the site of a Sun Oil Company refinery outside of Philadelphia, PA. Mr. Greenberg prepared an expert report and was deposed prior to settlement of the case.

Miami Heart Institute v. Heery & Heery, Architects, Miami, FL

Mr. Greenberg testified in the United States District Court for the Southern District of Florida on behalf of the Plaintiff. The case related to architectural errors and omissions committed for the design of a new wing of the hospital that housed surgical suites, CCU and ICU areas. Mr. Greenberg's testimony related to the delays and associated costs to repair and remediate design errors that violated the building codes. The Defendant was found to have violated the standard of care.

Raytheon Engineers & Constructors v. Roche Carolina, Inc., South Carolina, SC

Gary Greenberg worked closely with the defense team to prepare a counterclaim against the engineering design and procurement contractor for the construction of a \$650 million greenfield pharmaceutical plant in South Carolina. Mr. Greenberg's portion of the counterclaim and trial testimony related to the added construction costs and delays associated with engineering design errors and omissions. Mr. Greenberg was present during the entire trial that took place in Marion, SC to assist the defense team with strategy and cross examination.

Mortenson/Meyne v. Edward E. Gillen Company, Inc., Minneapolis, MN

Mr. Greenberg testified for the respondent in this arbitration proceeding



that took place in Minneapolis, MN. The case related to the mis-location of sixty-six caissons for the Comer Children's Hospital located at the University of Chicago in Chicago, IL. Mr. Greenberg's testimony related to the schedule impact of the misplaced caissons.

Al Johnson Construction Co. v. CSX Railroad, Pensacola, FL

Gary Greenberg provided expert testimony for the Defendant, the owner of a new railroad bridge that was constructed across Escambia Bay in Pensacola, FL. The trial took place in Leon County and Mr. Greenberg's testimony was in defense of a delay claim asserted by the general contractor.

Daniel O'Connell Sons/O&G Corporation v. Olympia & York, Hartford, CT

Mr. Greenberg provided expert testimony for the claimant in this arbitration proceeding that was held in Hartford, CT. The case related to the construction of a thirty-two story high rise commercial building in Hartford, CT. Mr. Greenberg provided expert testimony during the entitlement portion of bifurcated hearings that addressed four critical delays to the construction and the associated time extensions. The arbitration panel awarded the claimant ninety percent of the time claimed.



Judith M. LeClair

Senior Project Geologist

Areas of Expertise

Site Investigation and Remediation
Hazardous Waste Site Assessment
ASTM Phase I Environmental Site
Assessments and ASTM
Environmental Transaction Screens
Site and Project Management
UST Assessment/ Closure
Environmental Compliance

Years of Experience

With URS: 2 Years

With Other Firms: 12 Years

Education

Bachelor of Arts in Geological
Science, University of Maine, 1992

Master of Science in Earth Science,
North Carolina State University,
1995

Registration/Certification

n

OSHA HAZWOPER
OSHA HAZWOPER Supervisor
Loss Prevention System™ Training
Smith System Advanced Driving
Traffic Safety

Overview

Ms. LeClair is a geologist and Project Manager with experience in performing Phase I/II Site Assessments, hazardous waste site assessment, investigation, and remediation. She has worked with federal and state regulations governing environmental releases and site cleanup within five of the six New England states. In particular, Ms. LeClair's experience includes working on a number of sites within various stages of investigation and remediation under the Massachusetts Contingency Plan (MCP) and State of New Hampshire regulations.

Project experience includes a variety of commercial, municipal, state, and federal projects. Specialized areas include design and implementation of hydrogeologic investigations, including soil identification, lithologic interpretation, pump tests, slug tests, and modeling; site assessment activities under CERCLA, including Site Inspections and Site Reassessments; completion of Environmental Checklists (RCRA); Brownfield Targeted Site Assessments; assessment of in-situ remediation technologies; asbestos regulations; and National Environmental Policy Act (NEPA) compliance.

Project Specific Experience

Project Geologist

Former Chemical Distribution Facility, East Providence, Rhode Island (October 2007 through August 2010) – Vacant industrial property on the Providence River. The property was formerly used as a blending and repackaging facility and is now undergoing investigation under the State of the Rhode Island Environmental Management regulations. Ms. LeClair prepared the Site Investigation Report for submittal to RIDEM, a Remedial Design Investigation report, and bench scale testing protocols for assessment of chemical oxidation and microbial additives for remediation of the site. Completion of the Remedial Action Work Plan is currently under way, with a pilot test scheduled for spring 2009 and full-scale remediation soon thereafter.

Project Geologist

Plainville Sanitary Landfill, Plainville, Massachusetts (May 2009-February 2009) – Project Geologist tasked with preparation of semi-annual groundwater monitoring report, biennial post-closure groundwater quality report, and biennial post-closure Operations, Monitoring, and Maintenance report. As part of the Operations, Monitoring, and Maintenance report, an evaluation of the landfill's inspection practices and records generation was conducted.



Project Manager

Northeast United States Postal Service Facilities (April 2010 through present)– Project Manager for the Northeast Area USPS UST and AST compliance audits. Developed state regulatory questionnaires to assess compliance with state regulations, including a records review. Managed evaluation of a new assessment form for heating oil ASTs and USTs aimed at evaluating the safety and integrity of unregulated tanks. The project scope of work included field assessment and critique of the assessment form and a follow-up desktop survey utilizing USPS tank database information.

Project Manager

Chemical Distribution Facility, Tewksbury, Massachusetts – September 2008 through present) – Ms. LeClair is providing project management of field activities for the decommissioning of monitoring wells at this site. Access issues associated with this project include acting as liaison between the property owner the rail road company, which owns an abutting rail line. Access to the railroad right-of-way is required to property decommission one of the monitoring wells.

Project Manager

Food Processing Facility, Everett, Massachusetts, (October 2007-March 2008) – Project Manager for an investigation and assessment of food grade oil release to the sanitary sewer system. Responsibilities included preparation of MCP required submittals, included Release Notification Form, Immediate Response Action Plan and Completion Report, and Response Action Outcome statement. Provided liaison between property owner, municipal agency responsible for sewer system, Massachusetts DEP, and Massachusetts Water Resources Authority to facilitate system upgrades to the sanitary sewer system in the site vicinity.

Project Geologist

Marina Property, Weymouth, Massachusetts (October 2007-May 2008) – Marina property impacted with metals and PAHs from the presence of historic fertilizer manufacturing waste at the Site. Project involves comprehensive investigation of soil, sediment and groundwater impacts under the MCP. Responsibilities include preparation of RAM Plans, RAM Completion Reports, and Response Action Outcome Statement.

Project Manager

Environmental Site Assessments, New Hampshire, Vermont, and Massachusetts (January/February 2008) – Project Manager for bulk Phase 1 Environmental Site Assessment order for confidential client for numerous industrial facilities as part of a property transaction.



Responsibilities included staff management, client liaison, and quality control for deliverables.

Project Manager

Former Paperboard Manufacturing Facility, Natick, Massachusetts (March 2006 – August 2007) - Phase 1 ESA identified numerous Recognized Environmental Conditions, leading to the performance of a Phase II ESAs. The contaminant concentrations and discovery of free phase petroleum required the client to notify the state of the release within the framework of the Massachusetts Contingency Plan (MCP). When contamination was found to extend off-property and potentially on neighboring residential properties, extensive community involvement activities were initiated. Responsibilities included management of the Phase II ESA and follow-up work under the MCP, including Notification and preparation and implementation of an Immediate Response Action Plan, and oversight of community involvement activities.

Senior Geologist/Project Manager

Former Industrial Landfill, Charleston, Rhode Island (May 2006 – May 2007) – Phase II Brownfields Targeted Site Assessment/Site Investigation. Management of former private industrial landfill situated on an undeveloped 66-acre parcel. Wastes received and buried at the Site included dye wastes from and industrial wastes from what is presumed to be other sources. Investigation activities revealed that disposal area was more extensive and the types of waste more hazardous than originally reported. Due to potential exposure issues during the investigation. Responsibilities included project organization, oversight, and communication with RIDEM, and preparation of report deliverable.

Senior Geologist

Soil and Groundwater Environmental Remediation, Groton, Massachusetts (May 2006-August 2007) - Former tap and die manufacturing facility contaminated with TCE. Groundwater treatment system provides on-site containment of the main portion of the groundwater plume. An in-situ pilot study consisting of nano zero Valent iron (NZVI) and bioaugmentation is currently on-going to determine the feasibility for a permanent solution at the site under the Massachusetts Contingency Plan. Responsibilities included providing field support for collection of site data, evaluation of site analytical data, generation of regulatory evaluations and submittals as required by Massachusetts Department of Environmental Protection and the Environmental Protection Agency, including NPDES Exclusion permit reporting, completion of 5-year Temporary Solution evaluation; preparation of Release Abatement Measure (RAM) Plan and Completion Statements, and Phase III/VI Amendment.

Senior Geologist



Groundwater Remediation, Greenfield, Massachusetts (May 2006-August 2007) – Site is a former industrial facility contaminated with TCE with an active groundwater treatment system. Responsibilities included providing support for collection of hydrogeologic data, oversight of recovery well redevelopment, evaluation of site analytical data, and regulatory evaluations and submittals as required by Massachusetts Department of Environmental Protection and the Environmental Protection Agency. Evaluation of pilot test results from both bioaugmentation/biostimulation and in-situ chemical oxidation. Regulatory submittals included including NPDES Exclusion permit reporting, Phase III/VI Amendment, and Partial Response Action Outcome for off-site portion of the property.

Senior Geologist

USEPA Superfund Site, Corrina, Maine (July 2006 -March 2006). Served as Project Hydrogeologist for remediation of Operable Unit 1(Groundwater Contamination Source Area) for implementation of in-situ chemical oxidation with sodium persulfate. Responsibilities included calculating contaminant mass estimates, assessing groundwater flow and pump-test data, assessment of remedial process monitoring and confirmatory sampling data, and evaluation of properties for inclusion in the institutional control zone.

Project Manager/Project Geologist

Proposed Multi-unit Residential Development, Manchester-by-the-Sea, Massachusetts (1999) – Residential development was to be constructed in a dense residential section of Manchester that is not served by public sewer. Nearby residents were concerned about the potential for nutrient overloading and groundwater mounding from the proposed 10,000 gal/day septic system. As a result, the Town to require the property developer to perform a Nutrient Loading Study to determine if nitrate concentrations would impact a public beach and brackish pond located in close proximity to the site. Responsibilities included conducting a hydrogeologic investigation, including drilling oversight and logging, in-situ hydraulic conductivity testing, and collection background groundwater samples. The site-specific information collected was used to provide input parameters to a Method of Characteristics numerical groundwater flow model, which predicted nitrate concentrations across the study area and evaluated groundwater mounding from the system.

Site Remediation Manager

US Army Reserve Center, Lincoln, RI (August 2002-August 2003) – Supervised the completion of a Remedial Investigation (RI) required by Rhode Island Department of Environmental Management, which included a seismic refraction investigation of the subsurface, installation of monitoring wells in the overburden and bedrock, topographic survey to National Geodetic Vertical Datum, collection of soil and groundwater samples, data evaluation, limited fate and transport calculations, and completion of the RI report.



Project Hydrogeologist

Proposed 51-Lot Residential Subdivision, Hopkinton, Massachusetts (November 1999 – May 2000) - Performed a hydrogeologic investigation for a proposed 51-lot residential subdivision located partially within an Interim Wellhead Protection Area of three municipal water supply wells. The investigation was performed on behalf of a property development company at the request of the Town of Hopkinton. Test well locations utilizing available geologic information for the site vicinity and performed slug tests and a pumping test to determine aquifer characteristics. Estimated the extent of influence of the proposed private water supply wells on the municipal well field, as well as collected baseline data for existing private supply wells in the vicinity.

Site Manager

CERCLIS Site Inspections and Site Reassessments, U.S. EPA Region 1 under RAC I Contract - Site Manager for approximately ten Site Inspections (SIs) and Site Reassessments (SRs) in Massachusetts and Connecticut (November 2001-December 2005). Responsibilities included preparation of Field Task Work Plans and Health and Safety Plans, inspections of CERCLIS sites, collection of sludge, sediment, groundwater, and surface soil samples, and preparation of Site Inspection Prioritization Reports and Numerical Ranking System Worksheets. Experience includes familiarity with EPA's contract laboratory program and Delivery of Analytical Services systems. Work on Site Reassessments included evaluations of existing data, historical information, and numerical ranking for sites, additional research, and compilation of site information in a report evaluating future disposition of the Site (further assessment under CERCLA, archiving, or transfer of the site to State-Lead).

Project Geologist/Asbestos Inspector

Industrial Property, Corner of I-480 and Ridge Road, Brooklyn, OH (1996/1997) – Provided field support during the site characterization phase of a Brownfield property undergoing redevelopment under the Ohio EPA Voluntary Action Program. Field support included preparation of an ASTM Phase 1 Environmental Site Assessment report, collection of soil and groundwater samples using EPA protocols and performing slug tests. In addition, an asbestos survey of the five on-site buildings to determine types of ACM present and potential sampling locations. An asbestos containing material (ACM) report detailing the location, quantity, and estimated removal costs for each of the five buildings was prepared.

Project Manager

VA Landfill, Northampton, Massachusetts (2004-2006) – Responsible for performing a Qualitative Risk Assessment to assess the risk to human health and the environment posed by an inactive unlined, uncapped landfill. Based on the identified COCs, contaminant migration routes were assessed and exposure pathways were evaluated for current and foreseeable future site use. The Qualitative Risk Assessment was



performed in accordance with the Massachusetts Department of Environmental Protection Landfill Technical Guidance Manual.

Project Geologist/Project Manager

Environmental Site Assessments and Transaction Screenings: Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Ohio, Florida, Mississippi, Illinois, Indiana, Minnesota, New Jersey, North Carolina (1995-present) – Performed and/or managed over 150 ASTM Phase I Environmental Site Assessments and Transaction Screenings in various industrial, manufacturing, and commercial facilities.



Professional Societies/Affiliates

Society for Women Environmental Professionals, Massachusetts Chapter
Licensed Site Professionals Association (Non-LSP member)
National Ground Water Association

Chronology

2007 – Present, URS Corporation, Senior Project Geologist
2006 – 2007, MACTEC Engineering and Consulting, Project Manager
2001 – 2006, Nobis Engineering, Project Manager
1995 - 2001, Gemini Geotechnical Associates, Project Geologist

Contact Information

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Judith_LeClair@urscorp.com



Areas of Expertise

Construction Schedule Analysis and Preparation; Construction Claims Analysis

Years of Experience

With URS: 2 Years

With Other Firms: 19 Years

Education

Suffolk University B.S.
Government 1984

Northeastern University- Master
of Public Administration Courses
1986

Harvard University- Certificate
Program 1987

Lesley College- M.S.M. Business
Management 1990

Primavera Training Courses
ACEC Emerging Leaders
Seminar 2001

CMAA Review Course 2004

ABA "Fundamentals of
Construction Law" 2009

Professional Affiliations

Association of General
Contractor's-Massachusetts
Surety Claims Institute
Massachusetts Building Congress
Project Management Institute –
College of Scheduling
AACE International – PSP,
CFCC Candidate
Dispute Resolution Foundation
Training
American Bar Association
(Associate Member)
- Member of ABA Forum on the
Construction Industry
- Member of ABA Dispute
Resolution Forum

Francis A. Sabatino PSP

Senior Claim Analyst

Summary

Mr. Sabatino has over 19 years of diversified experience in the construction industry working with Owners, Attorneys, Architects/Engineers, Contractors, Construction Managers, Manufacturers, Surety, and other specialty consultants. He has provided various construction consulting solution services including the analysis of construction delay, acceleration, requests for equitable adjustments and loss of productivity claims. Services included detailed contemporaneous window analysis, disputed extra work claims, litigation support, and surety evaluations. Issues analyzed include as-planned versus as-built critical path comparisons, schedule delays and impacts, productivity, scope of work changes, unforeseen conditions, defective specifications, cost to complete and damages assessments. In addition, Mr. Sabatino has prepared program, master and project level CPM schedules for a wide variety of complex public and private construction. He included preparation of costs-to-complete, completion schedules, evaluation of payables and management of the project as a liaison between the contractor, surety and owner.

Mr. Sabatino cost assessment studies, forensic schedule and delay claim issues analysis, detailed written reports on a wide variety of manufacturing and construction projects have included the following areas of design and construction:

- Vertical Structures
- Historical Restorations
- Pharmaceutical Build-Outs
- Railroad Signal System Upgrades
- Train Stations Renovations
- Heavy Rail Car Manufacturing
- Tunnels for Highway and Rail Transit
- Petrol-Chemical Plants
- Wastewater Treatment Facilities
- Highways and Several Bridge
- Telecommunications
- Design Build Delivery Method on Several Types of Construction



Presentations

1998 - Bechtel\ PB JV -Central Artery Tunnel Project Master Schedule Initiative
2001 - MBTA Rail Project Managers – Claims Avoidance thru Schedule Sequencing
2008 – Simpson Gumpertz and Heger -Claims and Dispute Resolution -
2009 – Burns and Levinson - “What Every Construction Lawyer Needs to Know” *Another View of AACEI Recommended Practice 29R-03: Forensic Schedule Analysis*

Project Experience

Largest Civil Construction Project Boston, MA, Mass Highway Department \$14.65 b

Worked for owner and owner representative to develop and maintain Primavera P3.1 design, construction, and program schedules on the overall global project basis that included over 150+ construction contracts and 40+ design packages for the \$14.65B project. Reported monthly delays to 5 separate project substantial completion milestones, prepared risk assessment reports for construction contracts, applied earned value management to several key project contracts. Maintained individual contract project performance charts and adjusted percent completes based on earned value.

Vertical Construction Reporting New York, Citicorp

Prepared and reported on claim delay issues in support of contractor's cost overruns and schedule delay issues. Performed forensic cost to completes and schedule delays issues major diversified surety in regards to a multi-use condo and office complex located in Yonkers, NY.

University Student Housing High Rise Dormitory and Stadium Ohio, Case Western University

Prepare expert schedule report in defense of the Owner and Architect. Determine the Contractor and Subcontractor basis for equitable adjustment. Created 36 forensic schedules in determination of proper delay issue assessment and equitable adjustment compensability based on project documentation.

University Student and Administration High Rise Boston, MA, Emerson College

Duties included performing a cost to complete study, reviewing accounting status of subcontractors/vendors, reviewing all claims against the payment bond, and consulting the surety on completion options.

Historical Building Renovation Boston, MA, DCAM \$52m

Represented a contractor to enhance the contractors' time and documentation impacted delay claim of \$52 M+ based upon as-built schedules, defined time periods, contract submittals, letters and field and daily reports. Developed schedule and performance analyses based on as-built material and documentation.



Museum De Barrio Renovation New York, Rockmore Construction \$28m

Provide contractor with schedule and claim expertise on renovation of museum. Prepared and Schedule delay analysis for request for equitable adjustment and acceleration claim.

Bernard Finneson Hospital New York, DASNY \$3.6m

Represented the owner in evaluation of 5 delay and performance claim for a new medical facility consisting of Program Building, two 3 story residential and hospital wards, and 6 one story home facilities. Development of forensic schedule delay analysis model to determine delay responsibility for delays and performance issues as studied.

Pharmaceutical Laboratory Renovations Northeast, US, Wyeth

Scheduling and project oversight consulting services for several in-house laboratory build-outs which included cost analysis and earned value management reporting.

Tunnel/Vent and Retail Building Delay Assessment Boston, MA, Mass Highway Department, \$28m

Represented the owner to evaluate the contractors' time impacted delay claims of \$28M+ based upon as-built schedules, milestone performance payments, defined time period contract submittals, letters and field and daily reports. Develop forensic schedule and performance reports based on as-built material and documentation.

University Construction Risk Management Cambridge, MA

Provided professional services to include the following: a review of the contract documents and the general contractor labor rates in the pre-construction phase or early in the contract time, with a related memorandum of findings; a review of selected payment requisitions and related supporting documentation approximately at the 40%-50% (billings to contract value) completion stage with a memorandum of findings; and a final review at substantial completion or after final completion, which would include a final report and related meetings with University and Contractor personnel.



Brunswick Garden School Boston, MA City of Boston, Public School Department, \$4m

Mr. Sabatino developed from project schedules, project documentation, specifications, and contractors delay claim request a delay claim analysis and delay responsibility report. Used Primavera Project Planner to assess the contractors' time and documentation impacted delay claim based upon as-built schedules, defined time periods, contract submittals, letters and field and daily reports. Performed Applied Contemporaneous Windows Analysis Method.

British Airways Terminal 7 Renovation and Roadway Upgrade, New York and New Jersey Port Authority \$14m

Mr. Sabatino assessed a \$14m claim from British Airways project schedules, project documentation, specifications, and contractors delay claim request a delay claim analysis and delay responsibility report. Design Build method was project delivery, along with long term lease of owner's property. Reported on Risk assessment due to project delivery method and assessed cost and delay responsibility. Used Primavera Project Planner to assess the contractors' time and documentation impacted delay claim based upon as-built schedules, defined time periods, contract submittals, letters and field and daily reports.

Army Base Building Renovation Northeast USA, US Army

Duties included performing a cost to complete study, reviewing accounting status of subcontractors/vendors, reviewing all claims against the payment bond, and consulting the surety on completion options.

Manufacturing of Heavy Passenger Rail Nuremburg Germany/Boston, MA

Worked with the supplier to plan and develop a program plan for 24 restored heavy passenger rail cars and 94 manufactured heavy passenger rail cars. Duties also included monthly schedule reporting, monthly progress curve development and maintenance, and monthly progress and project trend reporting.



Grand Concourse, New York. NYCT Authority \$2.0m

Mr. Sabatino utilized Primavera Project Planner to enhance the contractors' time and documentation impacted delay claim based upon as-built schedules, defined time periods, contract submittals, letters and field and daily reports. Performed Applied Contemporaneous Windows Analysis Method.

Rail Signal Project Phoenix, Arizona, Valley Metro Rail \$2.1m

Preparation of both acceleration and delay claim for the major signaling equipment supplier .Reported the difference of cost for acceleration versus delay claim .Established critical path for both contractor and subcontractor.

Subway Signal Renovation, New York City Transit 28m

Prepared a delay claim for the subway signaling equipment supplier to reflect detailed and forecasted delays due to potential critical issues .Developed and analyzed the fully integrated master work plan, the schedule and the cost factors for the complete installation of the new equipment based on time restrictions and station sequencing requirements. Preparation of acceleration and delay claim for the signaling equipment contractor .Review of several denied claims reports and drafted several response positions

Subway Signal Renovation Project Northeast US, MBTA

Utilized Primavera Project Planner to enhance the contractors' time and documentation impacted delay claim based upon as-built schedules, defined time periods, contract submittals, letters and field and daily reports.

Subway Signal Renovation Project Northeast US, MBTA

Worked with the owner and owner representative to plan and develop the integrated master project design baseline. Also analyzed the progressed monthly schedules for resources, manpower and cost planning.

JFK Airport Central Utility Substation, Jamaica, NY, NY/NJ Port Authority \$1.4m

Performed a forensic schedule delay analysis based solely on project documentation including specifications, daily



reports, and minutes of meeting, quantity and change orders. Recreated project schedules based on project documentation.

Subway Fare Collection Project Northeast US, MBTA

Worked with the owner and owner representative to develop and analyze the fully integrated master work plan, schedule and cost basis for the complete installation of the new fare collection equipment based on time restriction and station sequencing.

Highway Department Road Expansion Northeast US, Mass Highway Department

Worked with the owner and owner representative to plan and develop the integrated master project for the design/build baseline for the 21-mile expansion of roadway, which included 31 bridges. Reported Time Impacted delays based on current work plan and developed recovery schedules for design build team

Cable Bridge Construction New York/New Jersey, NY/NJ Port Authority \$500m

Created the integrated master schedule for a Cable Span Bridge design. Provided delay assessment of environmental impact studies for design claim

Roadways and Bridge Construction Providence, RI, Rhode Island Department of Transportation \$5.3m

Mr. Sabatino utilized Primavera Project Planner to enhance the contractors' time and documentation impacted delay claim of \$5.3M+ based upon as-built schedules, defined time periods, contract submittals, letters and field and daily reports. He also developed written schedule and performance analyses based on as-built material and documentation. Applied Contemporaneous Windows Analysis Method. Awarded delay claim of \$5.3 million to contractor. Audit and risk management services to the financial state of several roadway and bridge projects to include the following services: Project cost and revenue forecasting, monthly cash flow development and monitoring, payables auditing, general conditions adjustments, change order management, contract balance reporting and project financial schedule integration. Mr. Sabatino updated cost to complete reports on 9 bonded



funds controlled projects to include the following information, cost to complete , general conditions, change order logs, pay requisitions, accounts payable, cash flow charts and curves, revised project bid quantities, and delay claims.

RIDOT Projects, Rhode Island \$22m

Mr. Sabatino has provided project management oversight and claims analysis to Sureties in termination and completion situations. Responsibilities included preparation of costs-to-complete, completion schedules, evaluation of payables and management of the project as a liaison between the contractor, surety and owner.

**Integrated FHWA District Program Planning
Jacksonville, Florida \$1.4b**

Worked with the owner and several local, state, private and federal entities and oversaw the development and implementation of a program master schedule, which included 100+ projected valued at \$84m. Monitored the overall master plan and schedule in connection with \$1.4B "Better City Plan". Developed delay claim analyses based on the analysis of contractor performance, unforeseen issues, weather related delays,

**Fiber-Optic Cabling Project USA/Transatlantic, MHD
and Local Municipalities**

Worked with Investment firm and owner to plan and develop the integrated master schedule which included developing and maintaining monthly progress charts and reports, schedule which included developing and maintaining monthly progress charts and reports, providing analyses of project schedule issues such as resources, time delays, access delays, permitting and what if scenarios and fully developing and issuing project reports based on query-requested data.



Jerome E. Von Hatten

Geotechnical Engineer

Overview

Mr. Von Hatten has extensive experience in geotechnical and environmental field exploration, landfill design, geosynthetics, grouting, in-situ testing, and instrumentation installation and environmental monitoring.

Areas of Expertise

Geotechnical Investigation
Waste Stabilization
Landfill Design
Instrumentation
Geosynthetics

Years of Experience

With URS: 32 Years

Education

BS/Civil Engineering/1996/Illinois
Institute of Technology
AS/Architecture/1974/Southern
Illinois University

Mr. Von Hatten is a principal geotechnical engineer for URS's Chicago office and directs the geotechnical activities relating to field investigations, foundation designs and stability analysis. He also has extensive experience in Chicago-area glacial soils and bedrock, as well as landfill design and closure of RCRA and CERCLA waste facilities.

Project Specific Experience

U.S. Steel – Jet Grout Wall and Armour Stone/Tie-back Support System and Sub Aqueous Cap

Mr. Von Hatten was the Project Manager and lead design engineer during the installation of a jet grout containment wall along an existing steel sheet pile wall at US Steel's Vessel Slip Turning Basin in Gary Indiana. During installation of the grout wall, a section of the existing sheet pile wall moved several feet at its toe which was supported by sediments and soft lake clays. URS terminated the grouting activities and provided a design to stabilize the sheet pile that included an armour stone wedge with additional tie-backs. Included in the armour stone design was a sub-aqueous cap consisting of layers of Organo-clay mat to minimize the release of product contained within the sediments. Mr. Von Hatten led the design of the wedge and tie-back stabilizing system, sub-aqueous cap, and provided construction management services for the preparation of the bid document and construction of the system. The existing sheet pile wall was stabilized with the armour stone wedge and tie-back system and the jet grout wall was completed. Monitoring of the area confirmed the sheet-pile wall has not shown additional movement and release of product to the lakes surface has not been observed in the area where the sub-aqueous cap has been installed.

Mittel Steel, East Chicago, Indiana – Design and Construction of a New Waste Water Treatment Basin Utilizing an Existing Waste Basin

Mr. Von Hatten was the Project Manager overseeing the design of a new waste water basin that included the stabilization of waste in an existing adjacent basin and using the stabilized sidewall as the one of the support wall for the new basin. Mr. Von Hatten directed bench scale tests on the waste and provided the recipe for stabilizing the waste to achieve a suitable strength for support of the side wall for the new basin. Mr. Von

Hatten managed the preparation of the construction documents, and provided construction management services during stabilization of wastes in the existing basin and throughout construction of the new basin.

Amoco, Whiting Indiana – Waste Stabilization of a Hazardous Waste Impoundment Adjacent to Lake Michigan

Mr. Von Hatten was the resident engineer for a 12 million dollar RCRA closure at an Amoco Whiting (IN) Refinery facility. These activities included:

- Perimeter waste containment via slurry and jet grouting walls.
- Waste solidification of 110,000 cubic yards of hazardous waste and containment of steel waste products within the impoundment using cement slurry.
- Construction of a groundwater control system that provides an inward gradient.
- Construction of a RCRA cover which consisted of various geosynthetics and a soil cover.

Mittel Steel, East Chicago, Indiana – Design and Construction of a Sediment and Waste Water Holding Basins

Mr. Von Hatten was the Project Manager overseeing the design of new sediment and waste water containment basins. This work included design and construction of two- 3.4 million gallon holding basins, one for containment of sediments and the other for containment of lake water that was accumulated during the hydraulic dredging process. Both basins were developed using existing concrete walls from an ore storage area for constructing the perimeter slopes of the clay lined basins. Mr. Von Hatten managed the preparation of the construction documents, and provided construction management services during the construction activities. He also monitored the stabilization of the sediments and off-site removal during disposal activities.

La Porte Indiana, Landfill Closure

Mr. Von Hatten was the Project Manager responsible for design and construction of a cover at an existing landfill in La Porte Indiana. He has successfully negotiated a cover system with the Indiana Department of Environmental Management that protects human health and the environment while allowing closure activities to be performed over an extended time period. Mr. Von Hatten was responsible for directing the preparation of the plans, specifications, engineers construction cost estimate and award of the construction contract. Mr. Von Hatten's team provided oversight of the landfill cover construction activities and preparation of the Construction Completion Report and Operation and Maintenance Plan.

U.S. Steel – Closure of Three Hazardous and Two Non-Hazardous Waste landfills

Mr. Von Hatten is the Project Manager responsible for the geotechnical investigations, preparation of Landfill Closure Plans, design and construction of the five landfill covers at U.S. Steels facility in Gary Indiana. Mr. Von Hatten experience in geotechnical investigation methods has provided U.S. Steel with sufficient information that demonstrates one landfill has an existing slag cap that meets the CFR regulations. Two of landfills will require waste stabilization prior to proceeding with cover construction in which partial depth stabilization is currently being evaluated. A sub-aqueous cap over existing sediments contained within a lagoon is also being considered as part of the closure process. This work is currently on-going with two of the landfill cover designs proposed to begin in 2009.

Janesville Disposal Facility, City of Janesville – Janesville, Wisconsin

Mr. Von Hatten was the Project Engineer responsible for the design and construction of 2-20 acre landfill covers. The covers were multi-layered and included a passive and active gas collection system. The project was completed (design through completion of construction) in an eleven-month period by implementing an accelerated schedule that included direct communication with the Agencies throughout all phases of the work.

More recently Mr. Von Hatten was the project engineer for the landfill investigation the lead to design of a dual gas/leachate collection system at the City of Janesville's active landfill. This work included: management of the field investigation, and the engineering and design services for which included preparation of all construction documents for bidding and award of the project. Communication with the WDNR throughout all phases of the work was required to complete the project within the clients accelerated schedule.

Former Wood River Refinery, Amoco Oil Company – Wood River, Illinois

Mr. Von Hatten has extensive experience with landfill design and field inspection. He worked for 7 years on the Amoco Wood River Refinery Project where he assisted in the design of a special waste landfill. His responsibilities included geomembrane liner and cover design, volume studies and computer modeling.

USEPA – Superfund Project, Fargo, North Dakota, Monitoring of Settlements During Remediation Activities

Mr. Von Hatten was the Project Engineer responsible for the installation of extensometer arrays and tilt meter, data management, and reporting of movements during "Six-Phase" soil heating remediation activities. The extensometers were monitored remotely via a data acquisition center. A data link provided by modems allowed the interception and transfer of movement data during soil remediation activities to URS's office in Chicago where the raw data was reduced and evaluated to determine soil

settlement near structures. The project was completed with no damage to the existing structures from the remediation activities.

**Metropolitan Water Reclamation District of Greater Chicago,
Material Transfer Tunnel for the McCook Reservoir**

Mr. Von Hatten was the Project Manager responsible for monitoring movements within the tunnel and along the ground surface during construction of a rock tunnel under the Des Plaines River and Interstate 55 for transfer of materials during construction of the McCook Reservoir. He assisted in preparation of the instrumentation specification which included extensometers, inclinometers, and convergence monitoring, and provided contractor oversight during instrument installation and monitoring activities.

Illinois Department of Transportation – McCook, Illinois (Joliet Road)

Mr. Von Hatten served as the Project Engineer on a geotechnical investigation of pavement failure and underlying bedrock stability. He managed the installation of geotechnical instrumentation and the field monitoring activities. Geotechnical monitoring included soil borings and rock corings, test pits, bedrock joint mapping, slope inclinometers, seismometers, manual and electronic joint/crack meters, video inspection of boreholes into bedrock, piezometers, and survey of vertical and horizontal surface movements.

Atigun Pass Oil Pipeline Stabilization Project – Alaska

Responsible for inspection of the grouting operations for stabilizing 600 linear ft of oil pipeline in weathered rock formations and installation of lateral movement and settlement instrumentation around and directly to the pipeline.

Mississippi River Locks & Dam No. 26 Rehabilitation Project – Alton, Illinois

Responsible for inspecting chemical grout plant operations; monitoring chemical grouting performance around concrete monoliths; and installing field instrumentation and performing field testing using settlement instrumentation, borros heave points, sondex equipment, lateral movement instrumentation, inclinometers, strain gages, load cells, and geophones for the U.S. Army Corps of Engineers' test program.

Geosynthetics

Mr. Von Hatten was responsible for the inspection and documentation of approximately 10+ million square feet of 40 and/or 60 mil High Density Polyethylene (HDPE) at landfill sites in Illinois, Indiana, New Jersey, Ohio and Kansas. He has also investigated the failure mechanism of a lined cooling water pond and assisted in preparation of conceptual remedial design to repair the liner. Since 1990 he has been the geosynthetic project specialist/engineer for a geosynthetic QC/QA program for a major landfill in Hong Kong (HK). His duties include



Jerome E. Von Hatten

coordination of QC and QA geosynthetic testing activities, review of test results, and submittal of compliance reports to the HK Environmental Protection Department.

Geotechnical Investigations

He has acquired expertise in supervision of subsurface investigation, performance of cone penetrometer and pressure meter tests, and related data processing during numerous assignments. Among them: Ponciana Island Development, Miami, Florida; Cargill Grain Storage Facilities, Evanston, Indiana; Lowry Landfill, Denver, Colorado; Imperial Valley Transmission Tower Foundation Study, San Diego, California; and One Magnificent Mile in Chicago, Illinois.

Professional Societies/Affiliates

Chi Epsilon Civil Engineering Honor Society

Specialized Training

OSHA 40-Hours Health & Safety Training

Chronology

1974 – Present: URS Corporation

Contact Information

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AVX Comments on Draft ESD #4 - 1st of 2 emails

Gary Gill-Austern

to:

NBH Comments

09/24/2010 03:18 PM

Cc:

Dave Dickerson, Cynthia Catri, ElaineT Stanley, 'Weldon', Mary Ryan

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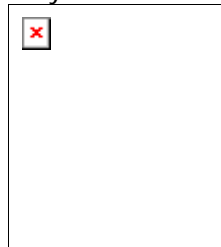
Attached please find the comments of AVX Corporation on the *June 2010 DRAFT - Fourth Explanation of Significant Differences for Use of a Lower Harbor CAD Cell*.

Please note that this is the first of two emails. AVX's comment letter is attached to this email. The comment letter's appendices as well as the resumes of the experts who provided technical assistance to AVX are attached to the forthcoming, second, email.

A hard copy of the comment letter, appendices and resumes is being sent simultaneously to EPA's designated address by U.S. first class mail.

Thank you.

Gary L. Gill-Austern



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AVX Comments on Draft ESD #4 - 2nd of 2 emails

Gary Gill-Austern

to:

NBH Comments

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Cc:

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Show Details

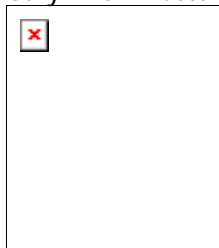
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Thank you.

Gary L. Gill-Austern



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